

THE
NUMERAL SYSTEMS
of
NIGERIAN LANGUAGES
(LAN Occasional Publications No. 2)

Edited By
OZO-MEKURI NDIMELE
&
EUGENE S. L. CHAN



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The Numeral Systems of Nigerian Languages

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**Ozo-mekuri Ndimele
&
Eugene S.L. Chan**

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In Collaboration with

The Linguistic Association of Nigeria (LAN)

Dedication

This book is dedicated to

All Lovers of Numeracy and Literacy

Preface

Most of the papers in this collection were read at the workshop on the numeral systems of Nigerian languages organised by the Linguistic Association of Nigeria during its 23rd Annual Conference which was held at the University of Port Harcourt, Nigeria. The interest to organise the workshop was borne out of the awareness created by Dr. Eugene S.L. Chan on the need for Nigerian linguists to document this severely endangered but very important aspect of our indigenous languages. Incidentally, the workshop was anchored by Dr. Chan himself. He led the discussion on the numeral systems of Nigerian languages and drew the attention of participants at the workshop to the good work he and his colleagues are doing in terms documenting and archiving the numeral systems of world languages.

Prior to the workshop on the numeral systems of Nigerian languages, Dr. Eugene S.L. Chan, working in collaboration with Professor Bernard Comrie and a couple of other colleagues, had begun documenting and archiving the traditional counting systems of many Nigerian languages. Day after day, those of us on his mailing list receive requests from Dr. Chan inviting Nigerian linguists to participate actively in their survey project on the numeral systems of Nigerian languages. To make the exercise worthwhile, he created a website which is specifically devoted for archiving numeral systems with the name of the contributors and institutional affiliations clearly indicated. You can become part of this life-long opportunity to participate in the survey and to have your contribution published online. Those interested to be part of the numeracy project and who have data to upload online should feel free to visit the following website on the numeral systems of world languages: <http://lingweb.eva.mpg.de/numeral/>.

A visit to the website will leave you with no choice but to ensure that the language you speak or the one you are working on as a linguist is part of this global concern. Please visit the website and see what gaps that exist and where you can contribute to the enrichment of the survey. It is obvious that Nigerian languages are the least represented in the survey. Of over 450 indigenous languages spoken in Nigeria, less than 100 have their numerals published in the famous website. It is a huge challenge for us linguists and speakers of these languages which are not yet reported. If you are willing to participate and to see your constructions published online, please send a mail to Dr. Eugene S.L. Chan at the following e-mail address: euslchan@yahoo.com.

It is amazing to observe the quantum of mathematical computations (e.g. addition, multiplication, subtraction, or a combination of two or all of these) involved in the numeral systems of world languages. In the survey conducted by Eugene S.L. Chan and his associates, a variety of numerals systems do exist, such as: binary, decimal, incomplete decimal, duodecimal, quinary, quaternary, ternary, mixed, body-part tally systems, etc. Perhaps, we have not yet seen it all. More data from a variety of world languages, including Nigerian languages, may present more fascinating systems not yet reported anywhere in the world.

This collection is the first in the series of what we hope will be a continuous exercise until we analyse and document as many numeral systems of our indigenous

Nigerian languages as our resources can carry us. It is a fact that the numeral system is the most endangered aspect of any language. That is the numeral system of a language may disappear and be replaced by that of another language even when the affected language is still active in other areas. In Nigeria, for instance, most young people can no longer count in their native languages even when they speak their languages fluently. The preference is the English counting system or the counting system a larger dominant Nigerian language which they also speak. The consequence of all this is that the numeral systems of some smaller languages are rapidly disappearing; hence, aggressive documentation of this aspect of our local languages is more compelling now than ever.

We are indeed grateful to the Executive Council of the Linguistic Association of Nigeria led by Professor Ahmed Amfani for granting us the permission to hold the workshop during the 23rd Annual Conference of the association that produced most of the papers in this volume. The role of the Department of Linguistics and Communications Studies, under the headship of Dr. (Mrs.) Christie U. Omega as at the time the conference was held, is also appreciated.

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The Yorùbá Numeral System¹

Oladiipo Ajiboye

This paper discusses the morphology, syntax and semantics of the Yorùbá cardinal numerals. As regards their morphology, it is shown that cardinal numerals divide into two: basic and derived. On the derived numerals, it is shown that there are two types: morphologically derived numerals via compounding or copying and sentential derived numerals. On their syntactic account, I propose the Universal Phrase Structure analysis using the Hurford's theoretical framework of packing strategy. Regarding their semantics, I show that while most languages use just the additive and multiplicative mechanisms; Yorùbá, in addition, has the third, namely, the subtractive mechanism. The Yorùbá fact reported herein calls for studies of numerals in other languages to see if there are those which have a division mechanism (the fourth possible type of strategy) in their counting system.

1 Introduction

There is no doubt that number concept and number process are parts of human endeavors. It is also not in doubt that these two date back to the origin of human race; thus every race has its system of numbering. As observed in Wiese (2007:760-761) number assignments across languages fall into three categories. One is the cardinality. The cardinal number assignments indicate the cardinality of sets and they identify the numerical quantity of objects such as (1a). The second is ordinality.² This class of numeral shows the position of an object within others (1b).

- (1) a. (i) Mo kọ ilé **m-éta**
1sg build house three
'I built three houses.'
- (ii) **Èta**³ ni ilé tí mo kọ
three FOC house that 1sg build
'It is three houses that I built.'
- b. Ilé **keji** ni mo n gbé
house second FOC 1sg prog live
'I live in the second house.'

¹ Thanks to Professor L.O. Adewole and Dr. Ayo Yusuff for their useful comments and suggestions. Special thanks go to the former for providing me with copies of Ekundayo and Oyelaran's papers cited in this work.

² Yorùbá is like Aja-Gbe which has a rather complicated numeral system similar to that of Fon-Gbe. In that language, there are two sets of 1 to 10; the first set is a number that is used when counting abstractly; the second set would be used for counting concrete items.

³ Today, many speakers of the language prefer *méta* instead.

The third type is the nominal numbering. It appears Yorùbá does not differentiate between ordinality and nominal number assignments in terms of the numerical representation.⁴ Whatever the case may be, the focus in this paper is the cardinal number assignments i.e., the kind of numerals shown in (1a). Since Yorùbá has two types as shown in the above examples, I will try as much as possible to exclude the *m*-type of the cardinals except where the need arises. This is because the concept of counting abstractly is the emphasis here.

A look at the Yorùbá literature shows that previous works on Yorùbá numerals can be divided into two depending on their depth, goal and approach. Bowen (1858: 47-50), Johnson (1921), Gaye and Beecroft (1923: 19-27), Ward's (1952), Odujinrin (1956: 7-17), Abraham (1958), Bamgbose's (1966), Oduyoye (1969), Longe (2009a, b) are all descriptive account of Yorùbá numeral system with the view of making them available for pedagogical use.⁵ Ekundayo (1972, 1977) and Awobuluyi (2008) go further to provide both descriptive and theoretical account of Yorùbá numeral systems.

In this paper, I first give a morphological account of the cardinal numerals with a view to bringing to the limelight the mechanisms that are involved in their derivation (section 2) and goes further to give a syntactic account within Hurford (2006)'s theoretical framework of 'packing strategy' (section 3). The paper proceeds to looking at the semantics of cardinal numerals (section 4) before drawing conclusions based on the proposed analyses (section 5).

2 The morphology of Yorùbá cardinal numerals

The Yorùbá numeral system is very complex.⁶ A work like this cannot capture all the processes observable in the data base. This section only briefly presents the morphological account of the essential aspects of the numerals that are crucial to my discussion. The numeral data that I present therefore split into two: basic and derived numerals.

⁴Other languages such as English have nominal number numerals expressed in (i).

(i) house #2

This type is used to indicate the identity of an element within it as set cf. Wiese (2007). In order to get what is close to English, Yorùbá needs an additional word.

(ii) ilé ojúlé kejì 'the house #2'
house face-house second

⁵ Odujinrin (1956:7-17) is purely pedagogical. This is clear from the title of the book and the section on numerals in particular. As such, one is not surprised that it is full of examples with a few lines of remarks at the introduction. Short as this introductory remarks is, however, it has a positive challenge for the generation yet unborn on the need to study Yorùbá numerals 'so that, apart from tracing up the history of modern currency, they may be used to interpret English figures and money in pure Yorùbá vernacular' (p. 7-8).

⁶ Bowen (1858:47-50) and Gaye and Beecroft (1923:19-27) classify Yorùbá numerals into cardinals, ordinals, distributive and adverbial numerals. The only thing interesting to us about their work is the distributive numerals, which according to Ajiboye & Déchaine (2004) and Ajiboye (2010) occur in two forms: the base form and the *m*-form and the base form and the *m*-form undergo reduplication, to form expressions of universal quantification. In addition, the *m*-form may undergo full reduplication, in which it is construed as a distributive quantifier.

2.1 Basic numerals

By basic numerals, I mean those numerals that are not derived i.e. numerals whose forms cannot be broken down into identifiable meaningful morphemes. The first group consists of numerals from one to ten (2).

(2)	a.	ení	‘one’
	b.	èjì	‘two’
	c.	èta	‘three’
	d.	èrin	‘four’
	e.	àrún	‘five’
	f.	èfà	‘six’
	g.	èje	‘seven’
	h.	èjọ	‘eight’
	i.	ẹsán	‘nine’
	j.	ẹwá	‘ten’

The second set of basic numerals shown in (3) consists of three numerals. It appears they have nothing in common other than being among other numerals that are in multiples of ten. One other thing to point out is that *ogún* and *igba* can be used in multiplication whereas *ogbòn* cannot (cf. Oduyoye 1969).⁷

(3)	a.	ogún	‘twenty’
	b.	ogbòn	‘thirty’
	c.	igba	‘two hundred’

Apart from the numerals that show up in (2) and (3) the rest numerals in Yorùbá are derived. I turn to the different ways by which those other numerals are derived in 2.2.

2.2 Derived numerals

Derivation according to O’Grady & Archibald (2008:116), ‘is an affixational process that forms a word with a meaning and/or category distinct from that of its base.’ As earlier mentioned, Yorùbá derived numerals are numerals whose forms can be broken down into identifiable morphemes (bound or free) or words. The derived numerals by this definition are predictably more complex. However, they fall into two broad classes: morphologically derived numerals comprising of copying and compounding and complex numerals that are sentential.

⁷Oduyoye (1969) is a pamphlet devoted to an account of Yorùbá numeration system. The author offers explanation on how the counting in 5, 10, 20, 200 etc. comes to being and goes a little further more than most of the works before her by explaining the role played by phonology in the morphology of numerals such as *ogóji* ‘forty’ versus *ogóta* ‘sixty’.

2.2.1 Morphologically derived numerals via copying

Copying in syntax otherwise known as reduplication in phonology and morphology is a process whereby the base is fully or partially copied and attached to the same base to derive new forms.

2.2.1.1 Full copying

As the name implies, full copying involves copying a complete morpheme or word to the left of the base. In Yorùbá numeral system, this may be followed by some other phonological processes. The examples in (4) show that after copying; there is an obligatory application of assimilation rule. In terms of interpretation, the derived numerals have distributive construal (Ajibóyè & Déchaine 2004). This is in consonance with the principle of word derivation, that, ‘once formed, derived words become independent lexical items that receive their own entry in a speaker’s mental dictionary’ (O’Grady & Archibald 2008:116).

(4)	<i>Base</i>	<i>Copying</i>	<i>Derived</i>
a.	òkan ‘one’	òkan òkan	òkòòkan ‘one by one’
b.	èjì ‘two’	èjì èjì	èjèèjì ‘two by two/ in twos’
c.	ogún ‘twenty’	ogún ogún	ogoogún ‘twenty by twenty’

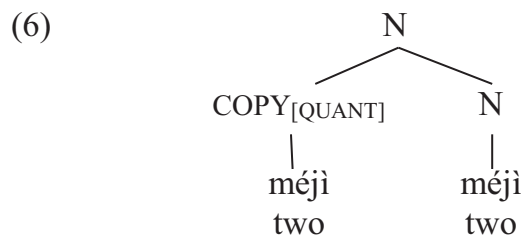
Further, in (5), we see something slightly different from what is reported in (4), namely, each pair of examples given has two forms: the first consists of pure copying whereas in the second pair of examples, in addition to copying, there is an obligatory assimilation rule applying. Crucially, it is necessary to point out the semantic effect of this phonological process in Yorùbá numeral system. Even though, both derived numerals are quantificational in nature, there is a difference in terms of the quantificational interpretation: while those with simple copying are distributive quantificational those ones that involve obligatory assimilation after copying show universal quantification (cf. Ajibóyè & Déchaine 2004).⁸

- (5) a. (i) Wón tò ní **méjì méjì**
 3pl lin-up in two two
 They lined up in twos (two by two)
- (ii) Mo ra **méjèèjì**
 1sg buy all two
 ‘I bought all the two.’
- b. (i) Mo ra [ilé **méta méta**] sí Èkó àti Àbújá
 1sg buy house three three P Lagos and Abuja
 ‘I bought **three houses each** in Lagos and Abuja.’

⁸ Note that, Ekundayo (1976:59) identifies three types of quantifiers in Yorùbá, namely, universal quantifier, absolute quantifier and relative quantifier. His classification however excludes temporal quantifiers.

- (ii) [Ilé **mètètèta**] tí mo rà sí Èkó ná mi ní mílíòònù mēwàá náírà
 house all-three that 1sg buy P Lagos 1sg ? million ten naira
 ‘**All the three houses** that I bought in Lagos cost me ten million naira.’

Though in a full copying, at a face value, it is difficult to show which of the two entities is the “base” and which one is the “copied”. However, both empirical (language internal) evidence⁹ and theoretical evidence show that the copied numeral is attached to the left of the base (Pulleyblank 2009). Indeed, looking at a wide range of data in accounting for copying in Yorùbá and using the ‘Syntactic operation of Copying’ Ajíbóyè & Déchaine (2004: 2) claim that the copied element is attached to the left of the base. This claim is in line with Hornstein (2001) where it is also asserted that the N-copy is attached to the left of the base in a Functional Phrase.¹⁰ Following this evidence, I propose the structure in (6) for all cases involving full reduplication.



I turn to the case that involves partial reduplication.

2.2.1.2 Partial copying

As the name suggests, in a partial copying, only some part of the base is copied. In Yorùbá numeral system, this morphological process is also employed in derived numerals that have distributive interpretation (cf. Ajíbóyè & Déchaine 2004).

- (7) a. àádóta [àd àádóta] àdàádóta
 fifty RED fifty fifty by fifty
- b. àádórin [àd àádórin] àdàádórin
 seventy RED seventy seventy by seventy¹¹

⁹ Consider gerundive nouns where the initial consonant of the verb is copied to the left of the root verb and a fixed high toned /i/ has to be inserted (contra Awobuluyi 2008’s argument that this is not always a high tone) to break the emerging consonant clusters which the language does not allow.

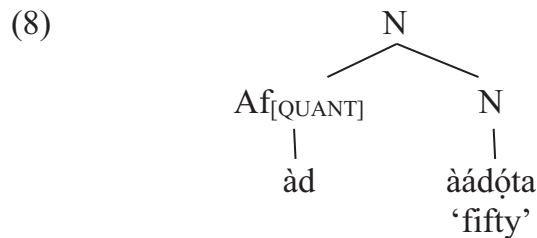
- (i) Base Copying /i/-insertion Gloss
 a. dé d+dé dídé arrive-ing
 b. sùn s+sùn sísùn sleep-ing

¹⁰For details on the syntax and semantics of ‘duplicative constructions in Yorùbá’, readers are referred to (Ajíbóyè & Déchaine 2004).

¹¹ Abraham (1958: xxxv) notes that consonant /d/ of the copied numeral in those examples can be displaced by the euphonic ‘r’, without a change in meaning.

The first striking thing about the examples in (7) is that those derived numerals are no more counting abstractly; rather, sets or groups are being counted. I treat this as the effect of phonology on morphology and semantics of such numerals. The other striking thing about those numerals is the “àá” morpheme which shows up at the beginning. The fact of the language reveals that *àá* is underlyingly *ẹwá* ‘ten’. First, the consonant deletes before the rule of regressive assimilation applies to the initial vowel.¹² As I show in 2.2.3, these examples too can be sententially derived. In fact, *àádóta* can be represented as *ẹwá dín ní ọgún méta* ‘ten reduces out of twenty into three places’ underlyingly.

I treat the COPY entity as a kind of affix that is prefixed to the root in order to derive a distributive numeral. Consequently, I propose the structure in (8).



Observe that the prefix *àd-* attached to the base numeral noun to derive the distributive numerals.

2.2.2 Morphologically derived numerals: compounding

This second mechanism of derivation involves compounding. Compounding is a morphological process of merging two already existing numerals to form a new one. We observe this in numerals that involve the combination of *ọgún* ‘twenty’ and *igba* ‘two-hundred’ with another numeral of less numerical strength. We observe that counting in *ọgún* covers numerals between forty and a hundred and eighty as illustrated in (9) whereas counting in *igba* covers a much larger domain as shown in the representative examples in (10).

- (9)
- | | | | | |
|----|--------|-------|---|-------|
| a. | ọgún | ẹ̀jì | > | ogójì |
| | twenty | two | | forty |
| b. | ọgún | ẹ̀ta | > | ogóta |
| | twenty | three | | sixty |

¹² The case however is not as simple as this with higher numbers involving *ọgórùn-ún dín...* ‘a hundred is reduced from...’ or *ẹgbẹ̀rún dín...* ‘a thousand is reduced from...’ Both are realized as *ẹ̀dẹ̀-* as in (i).

- (i)
- | | | | | |
|----|-----------------|---|---------------|--------------------------|
| a. | ẹ̀dẹ̀gbẹ̀ta | < | ọgórùn-ún dín | nínú ẹgbẹ̀ta |
| | ‘five hundred’ | | hundred | reduce from six hundred |
| b. | ẹ̀dẹ̀gbàata | | ẹgbẹ̀rún dín | nínú ẹgbàata |
| | ‘five thousand’ | | a thousand | reduce from six thousand |

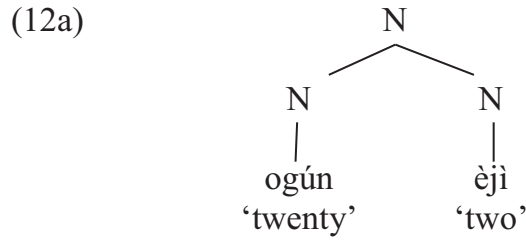
Note that the highest one can go in each of the examples in (i) is *ẹgbẹ̀ta* and *ẹgbàata* respectively.

	c.	ogún twenty	ẹfà six	>	ogófà a hundred and twenty
	d.	ogún twenty	ẹje seven	>	ogóje a hundred and forty
	e.	ogún twenty	ẹjọ eight	>	ogójọ a hundred and sixty
	f.	ogún twenty	ẹsán nine	>	ogójọ a hundred and eighty
(10)	a.	igba two hundred	ẹjì two	>	egbẹjì four hundred
	b.	igba two hundred	ẹrin four	>	egbẹrin eight-hundred
	c.	igba two hundred	òkanlá eleven		egbòkànlá two thousand and two hundred

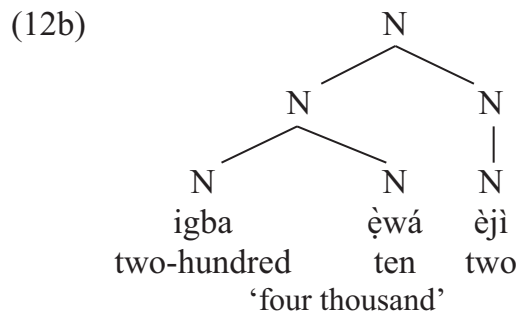
We also notice that an already derived numerals like *ẹgbàá* (*igba* ọ̀nà ẹ̀wá ‘200 x 10’ = 2000’) can further serve as input to derive other numerals of the type under consideration as the examples in (11) illustrate.

(11)	a.	ẹgbàá two-thousand	ẹjì two	>	ẹgbàajì four thousand
	b.	ẹgbàá two-thousand	ẹta three	>	ẹgbàata six thousand
	c.	ẹgbàá two-thousand	ẹrin four	>	ẹgbàarin eight thousand
	d.	ẹgbàá two-thousand	ẹje seven	>	ẹgbàaje fourteen thousand

From the examples above, it is clear that numerals formed by compounding involve combination of two already existent numerals and the resulting compound is a nominal numeral. I propose the structure in (12) to capture this derivation.



As for the complex compounding, the structure will look like (12b), where *ẹgbàá* is first derived from *igba* and before the intermediate output combined forms like *èjì*, *ẹta*, etc.



Note that the intermediate level derives *ẹgbàá* which in turn serves as input that combines with *èjì*.

The data in (9)-(11) are unique in the sense that, though, the derivation yields multiplicative numbers, the process involves a zero multiplication element.¹³

There is yet another remark to make with respect to the type of numerals under discussion. The numerals such *ogún*, *ogbòn*, *igba*, *irinwó* are not derived. Going by the formation of numerals from eleven upwards, one expects *ogún* to be *èwájì*, *ogbòn* to be *èwáta* and *irinwó* to be *egbèjì*, etc. For the pedagogical implication, following Oyelaran (1980) and Longe (2009)¹⁴, one may suggest a modification of the traditional system of counting involving the above numerals, so that learning these numerals by a child can be made simpler and easier.

There is yet another variety of numerals that is formed by the combination of *owó* 'cowry' with numeral to derive other numerals. This numeral system is referred to

¹³ Note however, that in a non-technical way of counting, the morpheme *ònà/lònà* 'into' may be employed. For example *ogún èjì* can be expressed as *ogún ònà/lònà èjì*.

¹⁴ Longe (2009a, b) is the most recent and comprehensive work on Yorùbá numeral systems. While Longe (2009a) has its focus on *Yorùbá Decimal Number System*, Longe (2009b) is on *the Yorùbá Vigesimal Number System*. The major contribution of the two works is the proposal to eliminate the subtraction mechanism thereby simplifying the counting system. Although, this new proposal is a welcome development, it is not without its shortcomings. The prospects and problems of the proposal are being examined in an ongoing research by this author.

as ‘counting by cowries’ (Johnson 1921: li-iii, Abraham 1958: xxxii-xxxiv).¹⁵ The data in (13) contain some examples.

(13)	a.	owó money	òkan one	oókan one (cowry)
	b.	owó money	èjì two	eéjì two (cowries)
	c.	owó money	èta three	ẹẹta three (cowries)
	d.	owó money	ẹfà six	ẹẹfà six (cowries)
	e.	owó money	ẹje seven	eẹje ¹⁶ seven (cowries)

Even though semantically, the word *owó* ‘money’ is involved in this type of numeral, it does not necessarily reflect in their interpretation today as we find people counting ordinary numbers or objects using this form. What I show above is slightly different from the one reported in Abraham (1958). Such derived numerals according to Abraham yield the forms such as those shown in (14).¹⁷

(14)	a.	éjì	‘two’
	b.	ẹrin	‘four’
	c.	ẹfà	‘six’

Abraham describes such numerals as “Long Forms”.¹⁸ One unique thing about those numerals is the presence of a high tone on the initial vowel. I return to this shortly.

¹⁵ Johnson (1921: 1) refers to this system as numismatics i.e. numerals whose formation involves the use of cowries that will be equivalence of coins in this modern time application. Indeed, Abraham (op.cit) describes these forms as ways of counting cowries since they contain *owó* and provides some precise account of how Yorùbá numerals are derived. However, Ekundayo (1977: 436) refers to Abraham’s account as taxonomic.

¹⁶ It appears *okòó* ‘twenty’ is derived in the same way as those numerals under review: *okùn owó kan* ‘one string of cowries’.

¹⁷ According to Adewole (personal communication) many speakers of Standard Yorùbá will say *oókan*, *eéjì* even in fast speech. This observation is in consonance with the account given below.

¹⁸ Unfortunately, whether by the examples given or the explanation provided, Abraham does not reveal to us how those forms are long. In our own proposal below, we show truly that those forms are actually longer than their counterparts without the noun *owó*. Thus, one cowry is actually *oókan* (<*owó òkan*) and not *ókan* as presented in Abraham’s work.

Transforming Abraham's description into a formal analysis in the Derivative (Generative) Approach (Chomsky & Halle 1968), the analysis will look like (15).

(15)	/owó	+	òkan/	/owó	+	èjì/	Underlying Representation
	o ó		kan	o ó		èjì	w-Deletion
	--			o é		èjì	Replace 'ó' with 'e'
	--			é		jì	Delete 'e' with its L tone
			[ókan]			[éjì]	Surface Form

The morphological account above is very thoughtful and informative in a number of ways. For instance, it helps in identifying the underlying/base forms of those numerals and the fact that there are some phonological rules that must apply to the underlying forms before we can attain what we have in the surface structure. However, we observe some inadequacies in Abraham's account. First is the fact that it fails to account for the disappearance of the initial vowel of *owó* 'money' and the initial vowel of *òkan* 'one'. Second and more crucially is the phonological fact that V-initial nouns in Yorùbá whether basic or derived do not begin with a high toned vowel. Third is the way the rules are formulated.

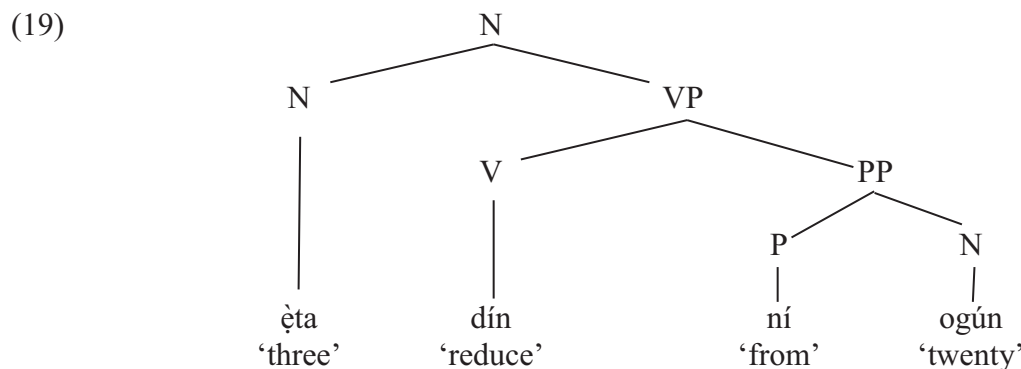
One way of solving the first two problems is to recognize the fact that the initial vowel of the word for money i.e. the mid toned 'o' is never deleted and must be pronounced in the surface form. This indeed is the case with most speakers of the language as we notice the realization of such numerals as *oókan*, *eéjì*, etc.

With the above highlighted problems, it becomes necessary to modify Abraham's proposal in order to get the true picture. In particular, we need to modify his rules and add new ones to be able to get the correct derivation. In view of this, I propose two rules of deletion; one that deletes the sonorant consonant /w/ of *owó* 'money', and the other that deletes the initial vowel of the numeral. Other rules that need to be applied are L tone deletion, High tone shift and Regressive assimilation. With these new rules, we do not need the "Replace 'o' with 'e'" rule as this has been taken care of in our "Assimilation Rule". I demonstrate the application of these phonological rules as follows.

(16)	/owó	+	òkan/	Underlying Representation
	o ó		òkan	w-Deletion
	o ó		kan	Deletion of V-initial of the numeral
	o ó		kan	L tone-Deletion
			[oókan]	Surface Form

b.	ẹ̀ta	dín	ní	ogún	> ẹ̀tádínlógún	20 – 3 = 17
	three	lesson	to	twenty	> seventeen	

The account of these numerals shows that each of them is underlyingly a meaningful sentence which comes as a numeral word in the surface form. The derivation is shown in (19).



Employing the merging mechanism of the Minimalist Program (Chomsky 1995); first, the preposition *ní* and the object noun *ogún* merge to form the PP *ní ogún* which in turn merge with the verb *dín* to form the VP *dín ní ogún* to and finally, the subject noun *ẹ̀ta* merge with the whole VP to form the numeral *ẹ̀tádín ní ogún*.²¹

However, the account given here which can be referred to as the traditional approach is at variance with Awobuluyi's (2008) account discussed in 2.2.3.2.

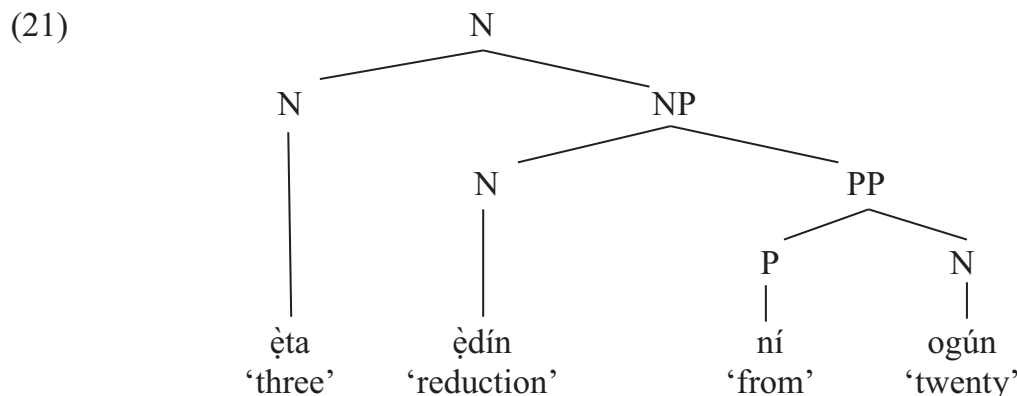
2.2.3.2 Complex numerals 2

Awobuluyi's (2008:100-101) account claims that numerals of this type consist of a numeral noun followed by a nomianlized morpheme that shows the reduction or surplus which in turn is followed by another numeral of a higher value. Such numerals are derived as in (20).

(20)	a.	(i)	òkàndínlógún < nineteen	òkan-ẹ̀dín-ní-ogún one-reduction-from-twenty	(1 - 20 = 19)
		(ii)	òkànlélógún twenty-one	òkan-èlé-ní-ogún one-surplus-on-twenty	(20 + 1 = 21)
	b.	(i)	méjídínlógún < eighteen	méjì-ẹ̀dín-ní-ogún two-reduction-from-twenty	(2 - 20 = 18)

²¹ Note that there supposed to be a tonal difference on *ẹ̀ta* as what is actually pronounced is *ẹ̀tá*. We return to how this is to be accounted for shortly.

(ii)	méjìlélógún	méjì-èlé-ní-ogún	(2 + 20 = 22)
	twenty-two	two-addition-on-top-twenty	



(Adaptation of Awobuluyi's 2008 analysis)

Awobuluyi's assumption anchors on the presence of the low tone of the second syllable of the derived numerals of the type in (20a) which is contrary to the expected mid tone if the forms were to be treated as sentential. Instead of the presence of the verbal element *dín*, Awobuluyi suggests the nominal element *èdín*. According to this proposal, the realization of the low tone on *òkàndínlógún* and the likes is straightforwardly accounted for: as the initial vowel of this nominal element deletes, its low tone is retained. This low tone in turn displaces the mid tone on the second vowel of the numeral *òkan* 'one', *èta* 'three' etc. Going further in canvassing for this position, Awobuluyi states that if indeed these numerals are sentential, what we ought to have for numerals such as *mètàlélógún* 'twenty-three' will be **mètaálélógún*, an unattested form. Note that *mètaálélógún* will have *mèta lé ní ogún* in its underlying representation. The presence of the HTS after the subject noun is syntactically derived (Awobuluyi 1975).

A few remarks will be in line here. It may not necessarily be the case that we have the HTS in those numerals. For instance it may be assumed that those numerals are actually without the HTS as in imperative sentences.

On the choice of *èdín* and *èlé* in place of *dín* and *lé*; though, this representation solves the tonal problem but it raises the problem of empirical evidence for such underlying representations. Whether in the early Generative Grammar (Chomsky 1957) or in the modern Generative Grammar as in the Minimalist Program (1995), what is being considered as natural and desirable is a simple representation rather than complex one. The proposal that has verbal representation is simpler and therefore more economical than the one that has a nominal representation: while those verbs are monosyllabic of CV structure, the nominal representation is considered to be more complex as they have VCV syllable structure. This apart, I think it is even more desirable to have an underlying representation that is closer to the surface form than to

the abstract representation which is far from what we have in the surface form. Considering the two options before us, it appears that the sentential representation is closer to what we have in the surface form than the one contained in Awobuluyi's compounding representation.

Another advantage that the traditional approach I canvass for has over Awobuluyi's is that it will be easier for a child to process these numerals. Indeed we can have the forms in (21a.i & b.i) as real numerals as in when we count slowly and the child will be able to process the meaning.

- (22) a. i. èta lé ní ogún
 three increase on twenty
- ii. èta èlé ní ogún
 three surplus on twenty
- b. i. èta dín ní ogún
 three lesson to twenty
 'three is reduced from twenty'
- ii. èta èdín ní ogún
 three reduction from twenty

On the contrary, it sounds somehow odd to have forms like (22a.ii & b.ii) in the surface forms.

The above argument may have not completely answered the question of how we come about the low tone if we assume a sentential representation of those numerals as it will sound strange to assume that the low tone in numerals derived from the sentential postulation just comes from nowhere. However, I must also say that this is not the only context in which a different tone appears in the surface syntax or morphology in the language. I will give three different instances. First, consider the case of a low toned monosyllabic verb that surfaces as mid whenever the verb takes an object noun.

- (23) Adé ra ìwé < Adé rà ìwé
 A. buy book
 'Ade bought a/the book/books'

This case has been widely reported in the literature. In Phonology, this mid tone is described as a default tone that is assigned in the absence of a high or a low tone (Akinlabi 1985 and Pulleyblank 1986). On the other hand Déchaine (2001) and a recent experimental study, Ajiboye et al. (2008) describe the same phenomenon as a syntactically derived M-tone.

There is another context in Standard Yorùbá where a mid tone which we do not have in the underlying representation is found in the surface form. This is in certain derived lexical items such as in (24).

(24)	a.	òpòlòpò	‘many’	<	òpò ní òpò
	b.	òtòlòtò	‘different one’	<	òtò ní òtò
	c.	ìpayà	‘anxiety’	<	ìpá àyà
	d.	ìgbeyàwó	‘marriage’	<	ìgbé ìyàwó
	e.	ìkejì	‘second’	<	ìkó èjì

This process has also been treated as morphologically conditioned ‘Derived mid tone’ in Ajíbóyè et al. (2008).²²

The third case reported in Durvasula (2005) is treated as an unpredictable tonal phenomenon. In this particular case, a low tone is found in a derived lexical item.

(25)	ogbó	eni	>	ògbèni	‘sir/Mr.’
	old	person			

Note here that the low tone on the initial vowel of the derived word was not there in the input.

Finally, although the data presented on the morphology of Yorùbá numeral system above is not exhaustive there is no doubt that it represents all the areas that my analysis is aimed at addressing. What remains to be addressed is the syntactic analysis.

3 The syntax of Yorùbá numerals: Packing strategy analysis

Having presented a descriptive account of the morphology of Yorùbá numerals, what I aim at achieving in this section is a theoretical account of the syntax of these numerals. I propose an analysis of Yorùbá numerals using the packing strategy of Hurford (1975, 1987, 2006). Simply put, the packing strategy is a mathematical mechanism that helps in accounting for compound numerals. It anchors on two principles and rules which generate all and only the well-formed numeral expressions in an economic way without losing their semantics (Hurford 2006:773).

As we know, the arithmetic of numerals makes available four basic ways of numerical calculations namely, addition, subtraction, multiplication and division. However, language is at liberty to choose among these four basic ways in building its numerals. The Packing strategy in numeral systems according to Hurford (2006), applies in a wide dimension especially in such languages whose counting system

²² The same phenomenon, which is also very robust in Mòbà, a dialect of Yorùbá, has been treated as an instance of High-Low tone simplification (Abiódún & Ajíbóyè 2008). Note that the presence of the HTS which we have in those ill-formed examples from Awobuluyi (2008): *méta-á-dínlógún and *méta-á-lélógún etc. is purely a syntactic affair in a syntactic phrase, whereas the case under consideration though is also syntactically inclined, differs in that it is in the morphology. We probably need more study in the area of tone behavior and tone change in Yorùbá to put us right.

makes use of ‘syntactic constructions to signal addition and multiplication’. Working within the framework of Generative Grammar, The packing strategy makes use of precise syntactic and semantic rules in accounting for numeral forms that are grammatical in language. Hurford’s (2006) proposed phrase structure rules for numerals are presented in (26).²³

(26) Universal Phrase Structure Rules:

$$\begin{aligned} \text{NUMBER} &\rightarrow \left\{ \begin{array}{c} \text{DIGIT} \\ \text{PHRASE (NUMBER)} \end{array} \right\} && \text{(Interpreted by addition)} \\ \text{PHRASE} &\rightarrow (\text{NUMBER}) \text{ M} && \text{(Interpreted by multiplication)} \end{aligned}$$

The template proposed by Hurford (2006) is a good springboard for my analysis. However, Hurford’s (1975:211ff) proposal where he presents Yorùbá data is somehow narrow in scope as it only assumes there are only two strategies that languages can adopt: addition or multiplication. As already seen, Yorùbá has three strategies: addition, subtraction and multiplication. We guess that there may be languages that adopt division as well. In light of this, there is the need to modify Hurford’s proposal to capture cases like Yorùbá and languages that may have the fourth. Having said this, the modification that need be made is to assume that the arithmetic counting systems as they affect building up of numbers is binary. In this case, the four strategies can be reduced to two features using the bivalent representation: [$\pm$ ADDITION] and [$\pm$ MULTIPLICATION]. We are also at liberty to use the monovalent feature. If we adopt this then the two features expand to [ADDITION], [SUBTRACTION], [MULTIPLICATION] and [DIVISION]. The modification in (17) allows for a language like English to make use of the [ADDITION] and [MULTIPLICATION] features in its packing strategy whereas a language like Yorùbá will in addition to the two, employ the third feature, namely the [SUBTRACTION].

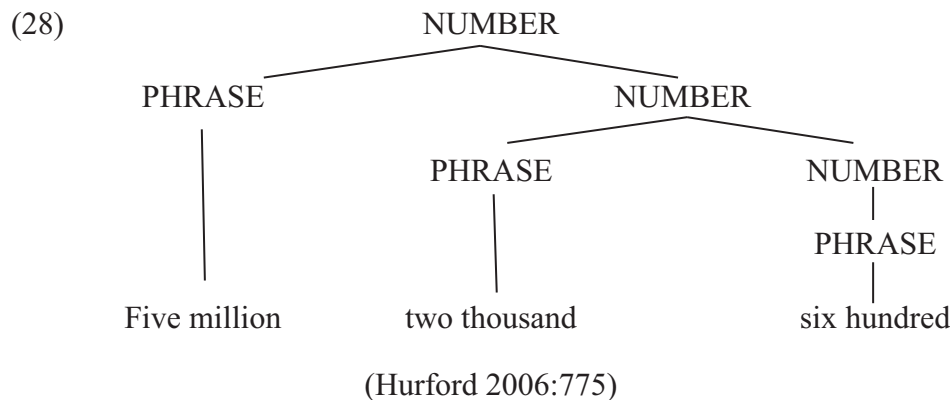
(27) Universal Phrase Structure Rules:

$$\begin{aligned} \text{NUMBER} &\rightarrow \left\{ \begin{array}{c} \text{DIGIT} \\ \text{PHRASE (NUMBER)} \end{array} \right\} && \text{(Interpreted by } [\pm \text{ ADDITION}]) \\ \text{PHRASE} &\rightarrow (\text{NUMBER}) \text{ M} && \text{(Interpreted by } [\pm \text{ MULTIPLICATION}]) \end{aligned}$$

Before going any further, it is necessary to describe the terminologies in (16) and (17). The term NUMBER in Hurford’s (2006) approach refers to any given numeral whether simple or complex. On the other hand, the term PHRASE may consist of ‘either a bare M or the sequence of NUMBER M. According to Hurford, ‘DIGIT consists of the

²³ Oduyoye (1969) is the closest to the present approach but she only mentions in passing the three mechanisms of counting, namely, addition, subtraction and multiplication with ample examples that illustrate her point. As to this, Oduyoye does not provide a concrete analysis of the numerals along these three strategies.

category of basic numerals like *one, two, three...nine*. Lastly, ‘M is the category of multiplicative base morphemes. As indicated in his structure, a NUMBER may be inside a PHRASE and a PHRASE can be inside a NUMBER. Similarly there are cases where DIGIT and M may be the same. The modification that I need to make in form of composition is the notion of PHRASE as expressed in Hurford’s proposal. Hurford makes it clear that the Phrase structure rules are recursive and looking at the English data, we note that the term simply refers to a NP which comprises of two juxtaposed numerals.



However, with the Yorùbá data already presented, PHRASE can be as small as a NOUN PHRASE as demonstrated in Hurford’s proposal and as big as a VERB PHRASE (as being proposed herein) depending on which wing of the structure it is found and the type of data that is in focus. For example, the PHRASE to the left of the structure is always an NP whereas when occurring to the right, the PHRASE can be an NP as in (29a) or a VP as in the case of (29b).

- (29) a. [NP [NP **ogún**] [NP èjì]]
 b. [S [NP **èjì**] [VP [V **dín**] [PP [P ní] [NP **ogún**]]]

Under our assumptions, the structure in (29b) should be understood as complex numerals that are full sentence on their own. Note that, adopting the NP in Hurford’s proposal acts like a true “Subject” in a non-derived sentence at least in a SVO language. We can now proceed to how Hurford’s packing strategies account for the fact of Yorùbá.

3.1 Accounting for the [± ADDITION] numerals

The first principle of Hurford’s (2006) proposal is “Go as far as you can with the resources you have”. This principle allows one to add to certain bigger number to derive new ones up to the maximum level that the language allows. By implication there must be at least two constituents for this principle to work. The Yorùbá counting system is in conformity with this principle. Yorùbá numerals can be divided into two.

On the one hand are numerals of the likes 11-14, 21-24, 31-34, 41-44, 201-204 etc. The numerals in this group make use of the [ADDITION] principle by adding from ‘one’ and up to ‘four’ which is how far we can go (to the next highest number) in order to build a new numeral. We take 11-14 as illustration.

- | | | | | | | |
|------|----|-------|----------|----|-----|------------|
| (30) | a. | òkan | lé | ní | ẹwá | ‘eleven’ |
| | | one | increase | on | ten | |
| | b. | ẹ̀jì | lé | ní | ẹwá | ‘twelve’ |
| | | two | increase | on | ten | |
| | c. | ẹ̀ta | lé | ní | ẹwá | ‘thirteen’ |
| | | three | increase | on | ten | |
| | d. | ẹ̀rin | lé | ní | ẹwá | ‘fourteen’ |
| | | four | increase | on | ten | |

Thus, *òkànlá* ‘11’ is rendered as *ẹwá* ‘ten’ is increased by *òkan* ‘one’; *ẹ̀jìlá* ‘12’ as *ẹwá* ‘ten’ increased by *ẹ̀jì* ‘two’; *ẹ̀tálá* ‘13’ as *ẹwá* ‘ten’ increased by *ẹ̀ta*; ‘three’ and *ẹ̀rìnlá* ‘14’ is rendered as *ẹwá* ‘ten’ increased by *ẹ̀rin* ‘four’. The process above involves the additive mechanism.

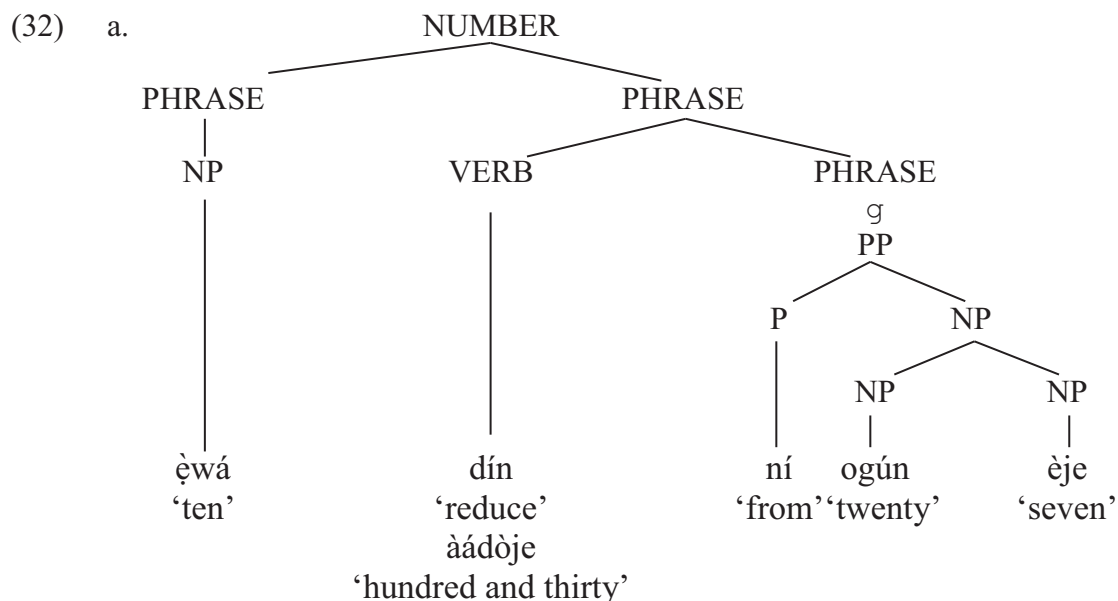
On the other hand are numerals such as 15-19, 25-29, 35-39, 45-49 etc. which make use of the [SUBTRACTION] principle: “Minimize the number of entities you are dealing with.”

- | | | | | | | |
|------|----|-------|--------|------|--------|-------------|
| (31) | a. | àrún | dín | ní | ogún | ‘fifteen’ |
| | | five | reduce | from | twenty | |
| | b. | ẹ̀rin | dín | ní | ogún | ‘sixteen’ |
| | | four | reduce | from | twenty | |
| | c. | ẹ̀ta | dín | ní | ogún | ‘seventeen’ |
| | | three | reduce | from | twenty | |
| | d. | ẹ̀jì | dín | ní | ogún | ‘eighteen’ |
| | | two | reduce | from | twenty | |
| | e. | òkan | dín | ní | ogún | ‘nineteen’ |
| | | one | reduce | from | twenty | |

Thus, *ẹ̀rìndínlógún* ‘sixteen’ is rendered as twenty reduced by four; *ẹ̀tadínlógún* ‘17’ is rendered as ‘*ogún* ‘twenty’ reduced by *ẹ̀ta* ‘three’. This goes on with the remaining numerals.

Despite the opposing strategies of addition for data in (30) and subtraction for data in (31), the two data sets converge in terms of our proposal of [$\pm$ ADDITION]

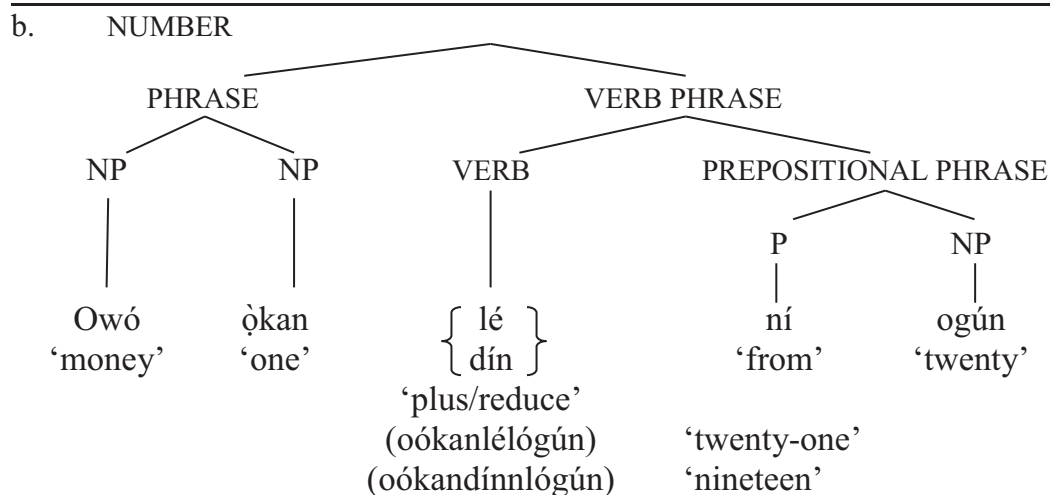
feature mechanism.²⁴ Consequently, I propose the structures in (32). Here the first PHRASE consists of a NP which may be a simple NP as in (32a) or a complex NP consisting of two juxtaposed NPs as in (32b), whereas the second PHRASE for each structure is made up of a VERB PHRASE headed by a V. This V takes a PREPOSITIONAL PHRASE as its complement.



²⁴ If Yorùbá were to be like English, it will only make use of the [ADDITION] feature in which case the forms in (31) will be rendered as (i).

(i)	a.	ẹfà	lé	ní	ogún	‘sixteen’
		six	increase	on	twenty	
	b.	ẹje	lé	ní	ogún	‘seventeen’
		seven	increase	on	twenty	
	c.	ẹjọ	lé	ní	ogún	‘eighteen’
		eight	increase	on	twenty	
	d.	ẹsán	lé	ní	ogún	‘nineteen’
		nine	increase	on	twenty	

Again, see Longe (2009a,b) on the new proposal which eliminates subtraction from the numeral system; a proposal that aims at simplifying the old system.



I now turn to the other packing strategy which involves a [$\pm$ MULTIPLICATION] feature.

3.2 Accounting for the [$\pm$ MULTIPLICATION] numerals

For the numerals involving [$+$ MULTIPLICATION] strategy, Hurford claims that “Higher-valued multiplicative bases are packed nearer the top of the phrase structure tree”. The way this works in English is that “the higher bases are ordered to the right of the lower ones” (Hurford 2006:775). First, I present relevant data in Yorùbá. There are three types of examples that I want to present. One derives numerals by *ogún* in multiples of *èjì* ‘two’, *èta* ‘three’ etc. Another derivation involves *igba* again in multiples of *èjì* ‘two’, *èta* ‘three’ etc. The last involves the use of *ẹgbàá* in multiples of *èjì* ‘two’, *èta* ‘three’ etc.

- | | | | | |
|------|----|--------|------------|----------------|
| (33) | a. | ogún | ogó~ogó- | ‘twenty’ |
| | b. | igba | egbè~egbè- | ‘two-hundred’ |
| | c. | ẹgbàá- | | ‘two-thousand’ |

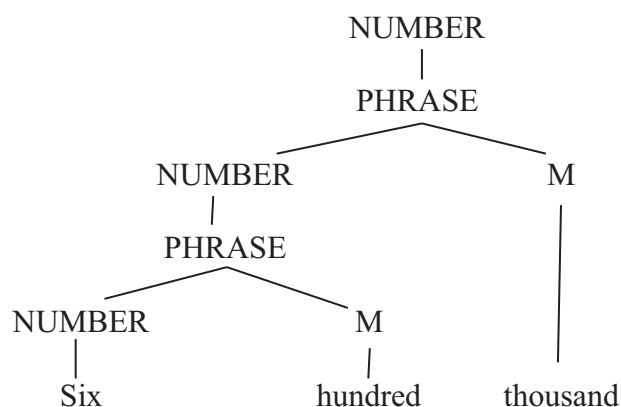
Note that the first two bases have allomorphs that are morphologically conditioned. On how those allomorphs are accounted for, readers are referred to Abraham (1958) and Awóbùlúyì (1992) among others. Some representative examples of numerals derived by this device are given in (34).

- | | | | |
|------|-------|-------------------|---------------|
| (34) | a.i. | ogún èjì | ogójì |
| | | twenty two | ‘forty’ |
| | a.ii. | ogún èta | ogóta |
| | | twenty three | ‘sixty’ |
| | b.i | igba èta | ẹgbèta |
| | | two-hundred three | ‘six-hundred’ |

- b.ii. igba èje egbèje
 two-hundred seven ‘hundred and forty’
- c.i ẹgbàá èje ẹgbàaje
 two-thousand seven ‘fourteen-thousand’
- c.ii. ẹgbàá ẹwá ẹgbàawá
 two-thousand ten ‘twenty-thousand’

Looking at Hurford examples from English and the structure proposed we see that in a numeral like *six hundred thousand*, the *thousand* which is the highest in number is on the rightmost side in conformity with the principle of packing strategy. This is followed by *hundred* which is also higher than *six*. Below, I present the structure proposed for English which Hurford claims can also apply to other languages.

(35)



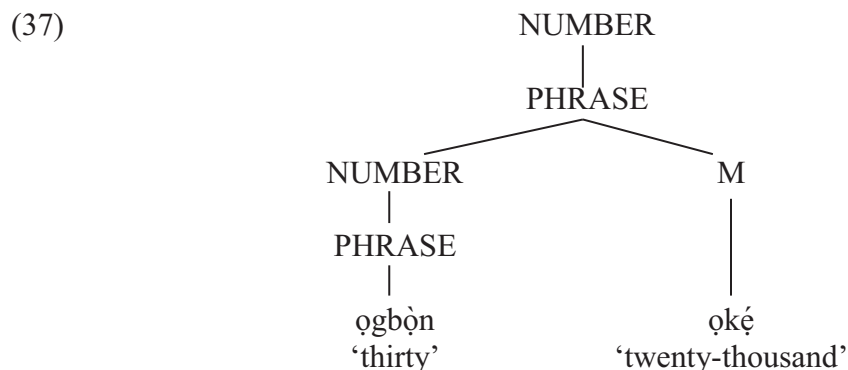
(Hurford 2006:775)

Coming to the Yorùbá case, I observe that what operates there is similar to English as shown in the following examples.

- (36) a. ogún ọkẹ ‘four hundred thousand’
 twenty twenty-thousand
- b. ọgbọn ọkẹ ‘six hundred thousand’
 thirty twenty-thousand
- c. àádọta ọkẹ ‘hundred thousand’
 fifty twenty-thousand

In particular, *ọkẹ* which is to the right of the number entity is higher than the numeral to its left. Going by those examples, the same structure proposed for English

straightforwardly accounts for Yorùbá data²⁵. As we can see, the structure in (37) is much simpler than Hurford's structure.



In what follows, I give a brief account of the semantics of Yorùbá numerals

4 The semantics of Yorùbá numeral system

This section discusses the compositionality of Yorùbá numerals. Recall that it has been asserted that Yorùbá makes use of addition, subtraction and multiplication strategies in the formation of its numerals. The goal here is to describe the way these three strategies manifest in the numerals. First, I present the relevant data.

- (38)
- | | | | | | | |
|----|--------|----------|---------|--------|-------------|-----------------------|
| a. | ẹ̀ta | lé | ní | ẹ̀wá | 'thirteen' | <i>addition</i> |
| | three | increase | on | ten | | |
| b. | ẹ̀ta | dín | ní | ogún | 'seventeen' | <i>subtraction</i> |
| | three | reduce | from | twenty | | |
| c. | ogún | ẹ̀jì | ogójì | | | <i>multiplication</i> |
| | twenty | two | 'forty' | | | |

For the addition and subtraction strategies, there are overt verbal elements coded in *lé* 'increase' and *dín* 'subtract' combining with a prepositional phrase (PP) to merge with the NP to the left. The preposition *ní*, which can be interpreted as 'on' when it occurs

²⁵ I must point out that Yorùbá numeral system is not as simple as presented above. This is evident by the examples below where Yorùbá case is a mirror image of English: 'the higher bases are ordered to the left of the lower ones'.

- | | | | | |
|-----|-----------------|-----------|---------|------------------------|
| i. | ọ̀ké | (ní ọ̀nà) | ọ̀gbọ̀n | 'Six hundred thousand' |
| | twenty-thousand | (in path) | thirty | |
| ii. | ẹ̀gbàawáá | (ní ọ̀nà) | ọ̀gbọ̀n | 'Six hundred thousand' |
| | twenty-thousand | (in path) | thirty | |

There is also the issue of whether we are to take *ẹ̀gbàawáá* as an entity or to break it down to *ẹ̀gbàà* 'two thousand' and *ẹ̀wá* 'ten'. If we hold on to the former, the mirror image proposal will stand. On the other hand, if we hold on to the latter, then, we have a pattern that is neither here nor there. There is more to do to understand the best structure that will capture all of the attested data in the language. See Ekundayo (1977) on the complexity of Yorùbá numerals system.

after the verbal element that denotes ‘addition’ morpheme, is also interpreted as ‘from’, when it occurs after the verbal element that denotes ‘subtraction’. As for the numerals involving multiplication they neither employ a verbal element nor require the presence of a preposition. Recall that in ordinary day to day use; there is (*ní ọ̀nà*) ‘in place’, a phrase that means ‘multiply by’, as in (39).

(39)	ogún	(ní ọ̀nà)	ẹ̀jì	>	ogójì
	twenty	in path	two		‘forty’
		multiplied by			

Surprisingly, this morpheme is not employed. Instead, the language prefers a zero morpheme for the multiplication morpheme. Thus there is an asymmetry behavior between numerals that make use of [$\pm$ ADDITION] which have as overt verbal elements and preposition and those numerals that make use of [$\pm$ MULTIPLICATION] which do not have such overt markers.

5 Conclusion

The clarion call made half a century ago by Odujinrin (1958:7) that ‘Yorùbá numerals, though they now appear obsolete, require to be specially studied by students of Yorùbá and by people with Yorùbá blood’ has been partially fulfilled in this study. What remains to be understood is the way Yorùbá numerals are created and employed in their day-to-day affairs. As for their morphology, it has been demonstrated that Yorùbá numerals could be derived or non-derived. As for their internal structure, I show that Hurford’ structure needs to be modified to include the verbal and prepositional elements within complex numerals. The work undertaken here is a tip in the iceberg of what can be done in trying to understand the complexity of Yorùbá numeral system. As for their semantics, it is shown that its additivity and subtraction compositionality devices are overtly reflected in the verbs *lé* ‘increase’ and *dín* ‘reduce/less’ whereas the multiplicity morpheme is represented by a zero morpheme.

List of Abbreviations

N	Noun
V	Verb
Af	Affix
QUANT	Quantification/Quantifier
P	Preposition

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The Numeral System of Nkọrọọ

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Nkọrọọ is an endangered Eastern Ijọ language spoken in Opobo/Nkọrọọ Local Government Area of Rivers State, Nigeria. Traditionally, Nkọrọọ operates a vigesimal numeral system but a modern system in which counting is done in base ten is being taught in schools. Both morphological and arithmetic methods are used in deriving Nkọrọọ numerals. The morphological methods include compounding (for cardinal numerals) and reduplication (for distributive numerals), while the arithmetic methods include multiplication, subtraction and addition. This paper discusses the derivation of three types of numerals: cardinal, ordinal and distributive.

1. Introduction

A numeral system is a writing system for expressing numbers. Generally, a numeral can be described as a sign, mark or symbol used to represent a number. However, in linguistics, numerals are specific words in a natural language that represent numbers. In Nkọrọọ, the traditional counting system is vigesimal, that is, counting is done in the base of twenty (the base refers to the number of digits that a numeral system uses to represent numbers) while the modern system of counting is decimal (base ten). The modern counting system is taught in schools and so is used mainly by the younger generation. But in everyday use and in counting money, the traditional way of counting is used by both the old and the young.

In this paper, we shall discuss the derivation of three types of numerals in Nkọrọọ – cardinal, ordinal and distributive numerals, and how they are used in modifying nouns. All data provided in this paper are a phonemic transcription of the sounds and not an orthographic representation since Nkọrọọ does not have a standard orthography.

1.1 Cardinal numerals

Cardinal numerals are considered basic in form, used for counting and in describing quantity. There are no distinct cardinal numerals that are used for counting different kinds of objects in Nkọrọọ. The same numerals are used for counting both human and non-human nouns. The basic counting forms consist of simple roots and include the numbers 1-10, 20 and 400. All these basic forms represent whole numbers but there is one partitive numeral that expresses a fraction which is; *pàkàrà* 'half'. *Pàkàrà* also means 'a piece of something'. The whole numbers are represented below.

1.	gbóri	'one'	sónómà	'seven'
	màmì	'two'	nínì	'eight'
	táru	'three'	ísíéní	'nine'
	něĩ	'four'	ójí	'ten'
	sónó	'five'	sí	'twenty'
	sóniá	'six'	óóóó	'four hundred'

1.1.1 Derivation of cardinal numerals

There are four ways by which other cardinal numerals may be formed. These are by compounding, multiplication, subtraction and addition.

a) By compounding

Compounding may involve a combination of *ójí* 'ten' and another numeral. It implies the addition of 10 to another numeral, though without an overt connective. Numerals 11-19 fall in this category. The forms presented here are used for counting in schools and so are mostly used by the younger generation. They reflect the modern system of counting which is done in base ten.

2.	ójí gbóri	'eleven'	ójí sóniá	'sixteen'
	ójí màmì	'twelve'	ójí sónómà	'seventeen'
	ójí tárú	'thirteen'	ójí nínì	'eighteen'
	ójí nǎí	'fourteen'	ójí ísíéní	'nineteen'
	ójí sónó	'fifteen'		

b) By multiplication

Another method of deriving numerals involves a combination of *sí* 'twenty' and another numeral. To achieve this, a low toned plural clitic *à*, which functions as a modifier, is suffixed to the other numeral. This indicates a multiplication of that numeral to the following numeral (that is, 20). Numerals 40, 60, 80, 100 and 200 fall into this category.

- | | | | | |
|----|---------------|--------|----------|-------------------------------------|
| 3. | màmì = à + sí | → | mààsí | 'forty' |
| | two=PCL | twenty | | |
| 4. | tárú = à + sí | → | tárásí | 'sixty' |
| | three=PCL | twenty | | |
| 5. | nǎí = à + sí | → | níàsì | 'eighty' |
| | four=PCL | twenty | | |
| 6. | sónó = à + sí | → | sónóà sì | 'one hundred' (5 multiplied by 20) |
| | five=PCL | twenty | | |
| 7. | ójí = à + sí | → | ójíà sì | 'two hundred' (10 multiplied by 20) |
| | ten=PCL | twenty | | |

For larger numerals above 700, *óḡḡḡ* 'four hundred' is multiplied with numerals 2, 3, 4, or 5. The plural clitic, *à*, is attached to the smaller digit. The number '2000' is derived in this way.

8. *sónó* = *à* + *óḡḡḡ* → *sónóà óḡḡḡ* 'two thousand' (5 multiplied by 400)
 five=PCL four hundred

In listing some of the linguistic features of the Ijoid family, Williamson and Blench (2000) denote *-a* as a prefix marking plural nouns that is preceded by a modifier. Jenewari (1977:321) while discussing the numeral system of Kalaḡari, denotes *a-* as a suffix which he calls a 'plurality marker'. But in this work, I have analysed *a* as a plural clitic because it occurs not only with numerals but also with nouns and adjectives and denotes the same meaning of plurality.

c) By subtraction

This involves the use of the verb *fâà* 'loss' or 'finish' which may be interpreted as 'less' in this context. It is applied to numerals 15-19 and is usually used for counting money. A lesser number is subtracted from *sí* 'twenty'. It is also the traditional method of counting numerals 15-19.

- | | | |
|-----|--------------------|-------------|
| 9. | <i>sónó fâ sí</i> | 'fifteen' |
| | five less twenty | |
| 10. | <i>něí fâ sí</i> | 'sixteen' |
| | four less twenty | |
| 11. | <i>tárú fâ sí</i> | 'seventeen' |
| | three less twenty | |
| 12. | <i>màmì fâ sí</i> | 'eighteen' |
| | two less twenty | |
| 13. | <i>gbóri fâ sí</i> | 'nineteen' |
| | one less twenty | |

Usually, in fast speech, *fâà* is reduced to *fâ*.

c) By addition

Apart from compounding *ójí* 'ten' and another numeral, the conjunction *na...na* 'and' can be used to derive other numerals. Such numerals include 21-29, 30-39, 41-49, 50-59, 61-69, 70-79, 81-89, 90-99 and so on.

14.	sí ná gbóri ná	'twenty one'
	twenty and one and	
15.	sí ná màmì nà	'twenty two'
	twenty and two and	
16.	sí ná sónó ná	'twenty five'
	twenty and five and	
17.	sí ná ójì ná	'thirty'
	twenty and ten and	
18.	sí ná ójì gbóri ná	'thirty one'
	twenty and ten one and	
19.	mààsí ná ójì ná	'fifty'
	forty and ten and	
20.	tárásí ná ójì ná	'seventy'
	sixty and ten and	
21.	níàsì nà ójì ná	'ninety'
	eighty and ten and	

1.1.2 Cardinal numeral forms used as attributes

The forms of the cardinal numerals 2, 3, and 4 are slightly different when used as attributes or noun modifiers. *Màmì* 'two' becomes *màà*, *tárú* 'three' becomes *tárá* and *něí* 'four' becomes *nîà* (probably a combination of the numerals and the plural clitic). Cardinal numeral 1 remains unchanged, while numerals 5 to 10 take the plural clitic *à*. However, with numeral 7, the change in form is not obvious because it ends in a low toned /à/.

22.	gbóri dʒìrì	'one book'	sónà dʒìrì	'five books'
	màà dʒìrì	'two books'	sónià dʒìrì	'six books'
	tárá dʒìrì	'three books'	sónómà dʒìrì	'seven books'
	nîà dʒìrì	'four books'	nínîà dʒìrì	'eight books'
	ísíénîà dʒìrì	'nine books'	ójìà dʒìrì	'ten books'
23.	gbóri tókù	'one child'		
	màà làlàpù/mà àwò	'two children'		
	tárá làlàpù	'three children'		

níà làlàpù	'four children'
sónà làlàpù	'five children'
sónià làlàpù	'six children'
sónómà làlàpù	'seven children'
nínìà làlàpù	'eight children'
ísíénìà làlàpù/ísíénìà àwò	'nine children'
ójíà làlàpù/ójíà àwò [ójíàwò]	'ten children'

Both *àwò* and *làlàpù* mean 'children'. However, in counting children, the term *làlàpù* is preferred except for numerals 2, 9 and 10 where both terms may be used. In examples (22 & 23) above, the cardinal numerals function as prenominal modifiers. This applies only to numbers one through nineteen (1-19).

24.	gbórí d3òwòì	'one paddle'
	màà d3òwòì	'two paddles'
	tárá d3òwòì	'three paddles'
	níà d3òwòì	'four paddles'
	sónà d3òwòì	'five paddles'
	sónià d3òwòì	'six paddles'
	sónómà d3òwòì	'seven paddles'
	nínìà d3òwòì	'eight paddles'
	ísíénìà d3òwòì	'nine paddles'
	ójíà d3òwòì	'ten paddles'
	ójí gbórí d3òwòì	'eleven paddles'
	ójí màà d3òwòì	'twelve paddles'

From 20 and above, the cardinals occur after the nouns they modify.

25.	d3òwòì sí	'twenty paddles'
	paddle twenty	
	d3òwòì sì nàwó màmi nà	'twenty two paddles'
	paddle twenty and two and	
	d3òwòì sì nàwó ójì ná	'thirty paddles'
	paddle twenty and ten and	
	d3òwòì = á máàsì	'forty paddles'
	paddle=PCL forty	

d̩́wǎí = á máàsì nàwó ójì ná paddle=PCL forty and ten and	'fifty paddles'
d̩́wǎí = á sónó = à sì paddle=PCL five=PCL twenty	'hundred paddles'
d̩́wǎí óbǎí paddle four hundred	'four hundred paddles'
d̩́wǎí óbǎí nàwó sónó sì nà paddle four hundred and five=PCL twenty and	'five hundred paddles'

1.1.2.1 Cardinal numerals and other nominal modifiers

Cardinal numerals may function as numeral modifiers alongside 'adjectives' (most Nkporo 'adjectives' are actually stative verbs functioning as nominal modifiers). Numerals 1 – 19 precede the adjective, while numerals 20 and above follow the adjective.

26. gbóri síè d̩́wǎí one be.bad paddle	'one bad paddle'
sónó = à síè d̩́wǎí five=PCL be.bad paddle	'five bad paddles'
ójí = à síè d̩́wǎí ten=PCL be.bad paddle	'ten bad paddles'
ójí gbóri síè d̩́wǎí ten one be.bad paddle	'eleven bad paddles'
ójí sónó = à síè d̩́wǎí ten five=PCL be.bad paddle	'fifteen bad paddles'
síè d̩́wǎí sì be.bad paddle twenty	'twenty bad paddles'
síè d̩́wǎí = á táràsì be.bad paddle=PCL sixty	'sixty bad paddles'
síè d̩́wǎí = á sónó = à sì be.bad paddle=PCL five=PCL twenty	'one hundred bad paddles'

Even when the adjectives modifying the noun are more than one, the numerals 1 – 19 still occur before the noun while 20 and above follow the noun.

27. gbóri ópù sìè d̥zòwǝĩ 'one big bad paddle'
 one big be.bad paddle
- gbóri ópù sìè pìnà d̥zòwǝĩ 'one big bad white paddle'
 one big be.bad be.white paddle
- màà òpù = à sìè d̥zòwǝĩ 'two big bad paddles'
 two big=PCL be.bad paddle
- màà òpù = à sìè pìnà d̥zòwǝĩ 'two big bad white paddles'
 two big=PCL be.bad be.white paddle
- òpù = à sìè d̥zòwǝĩ sì 'twenty big bad paddles'
 big=PCL be.bad paddle twenty
- òpù = à sìè pìnà d̥zòwǝĩ sì 'twenty big bad white paddles'
 big=PCL be.bad be.white paddle twenty
- òpù = à sìè d̥zòwǝĩ = á máàsì 'forty big bad paddles'
 big=PCL be.bad paddle=PCL forty
- òpù = à sìè pìnà d̥zòwǝĩ = á máàsì 'forty big bad white paddles'
 big=PCL be.bad be.white paddle=PCL forty

A summary of the basic cardinal numeral forms (i.e. consisting of simple roots) is shown in the table below:

Counting form	Modifying/attributive form	English gloss
gbóri	gbóri	'one'
màmì	màà	'two'
táru	tára	'three'
něĩ	nía	'four'
sónó	sónóà	'five'
sóniá	sónià	'six'

sónómà	sónómà	'seven'
nínì	nínìà	'eight'
ísíéní	ísíénìà	'nine'
ójí	ójíà	'ten'
sí	sí	'twenty'
ó6óó	ó6óó	'four hundred'

Table 1: A summary of Nkporo simple cardinal numeral forms.

2. Ordinal numerals

Ordinal numerals describe the position of objects in a sequential order. Apart from the first and last ordinal numerals, the others are formed by compounding a cardinal numeral and a verb, *káráamá*, meaning 'be complete'. In their citation forms, the ordinal compounds exhibit two tone patterns. If the cardinal numeral ends in a low tone, then the low tone spreads to only the first two syllables of *káráamá* and so we have *kàràamá*. But if it ends in a high tone, we have *káráamá*. Again, only the first two syllables of *káráamá* remain high. The last syllable becomes low.

28.	pípérí/púpérí, tárí	'first'	sónó káráamá	'fifth'
	màmì kàràamá	'second'	sóníá káráamá	'sixth'
	tárú káráamá	'third'	sónómà kàràamá	'seventh'
	něí káráamá	'fourth'	nínì kàràamá	'eighth'
	ísíéní káráamá	'ninth'	sí káráamá	'twentieth'
	ójí káráamá	'tenth'	kúnò-mà, òbùkùnò-mà	'last'

2.1 Ordinal numerals used as nominal modifiers

A similar thing happens when the ordinals modify a noun. The only difference is that *káráamá* retains all its high tones when it occurs after a numeral that ends in a high. Generally, the nouns become HL after an ordinal numeral that ends in a high tone and LL after an ordinal numeral that ends in a low tone. The data below shows some examples of the tonal changes that occur when nouns with LL, LH and HH tone patterns are modified by ordinal numerals.

Ordinal numeral + tàà 'wife' (LL Noun)

The first syllable of the LL noun assimilates the high tone of a preceding ordinal numeral and so becomes HL. Otherwise, the noun retains its low tones.

29.	pípérí tǎà/púpérí tǎà	'first wife'
	tárí tǎà	'first wife'
	màmì kàrà má tǎà	'second wife'
	táru kárá má tǎà	'third wife'
	sónómà kàrà má tǎà	'seventh wife'
	ójí kárá má tǎà	'tenth wife'
	òbùkùnòmà tǎà	'last wife'
	kùnòmà tǎà	'last wife'

Ordinal numeral + tòkú 'child' (LH Noun)

The LH noun becomes HL after an ordinal numeral that ends in a high tone and LL after an ordinal numeral that ends in a low tone.

30.	pípérí/púpérí tókù	'first child'
	màmì kàrà má tókù	'second child'
	táru kárá má tókù	'third child'
	sónó kárá má tókù	'fifth child'
	sónómà kàrà má tókù	'seventh child'
	nínì kàrà má tókù	'eighth child'
	òbùkùnòmà tókù	'last child'

Ordinal numeral + féré 'plate' (HH Noun)

HH nouns become HL after an ordinal numeral that ends in a high tone and LL after an ordinal numeral that ends in a low tone.

31.	pípérí/púpérí fèrè	'first plate'
	néí kárá má fèrè	'fourth plate'
	sóniá kárá má fèrè	'sixth plate'
	sónómà kàrà má fèrè	'seventh plate'
	nínì kàrà má fèrè	'eighth plate'
	òbùkùnòmà fèrè	'last plate'
	kùnòmà fèrè	'last plate'

2.1.1 Ordinal numerals and other nominal modifiers

Ordinal numerals may be used alongside 'adjectives' and the definite article in modifying nouns. In all cases, the ordinal precedes all other modifiers in the noun phrase, while the definite article occurs at the end of the phrase, after the noun. The

conventional order of these modifiers in the Nkporo noun phrase is as follows: ordinal numeral + adjective(s) + noun + definite article.

32. *Ordinal numeral + adjective + Noun*

pípérí/púpérí ólòm ìrìàrà	'first old woman'
màmì kàràamá ólòm ìrìàrà	'second old woman'
tárú kàràamá ólòm ìrìàrà	'third old woman'
sónó kàràamá ólòm ìrìàrà	'fifth old woman'
sí kàràamá ólòm ìrìàrà	'twentieth old woman'
òbù kùnòrà òlòm ìrìàrà/kùnòrà ìrìàrà	'last old woman'

33. *Ordinal numeral + adjective + Noun + definite article*

pípérí/púpérí ólòm ìrìàrà m	'The first old woman'
first be.old woman the	
òbùkùnòrà òlòm ìrìàrà m	'The last old woman'
last be.old woman the	

34. *Ordinal numeral + adjectives + Noun + definite article*

pípérí/púpérí íbì òlòm ìrìàrà m	'The first good old woman'
first be.good be.old woman the	
màmì kàràamá íbì òlòm ìrìàrà m	'The second good old woman'
two be.complete be.good be.old woman the	
òbù kùnòrà/kùnòrà íbì òlòm ìrìàrà m	'The last good old woman'
last be.good be.old woman the	
pípérí/púpérí dúbà íbì òlòm ìrìàrà m	'The first fat good old woman'
first be.fat be.good be.old woman the	
kùnòrà dùbà íbì òlòm ìrìàrà m	'The last fat good old woman'
last be.fat be.good be.old woman the	

3. Distributive numerals

A distributive numeral expresses a group of the number specified and describes an alternating order. Distributive numerals are derived in Nkporo either by partial or total reduplication of a cardinal numeral. For numerals 1 to 6, the first syllable of the cardinal numeral is reduplicated.

35.	Cardinal numeral	Distributive numeral
	gbóri 'one'	gbógbóri 'one by one'
	màmì 'two'	màmàmì 'two by two'
	tárú 'three'	tátárú 'three by three'
	néí 'four'	nénéí 'four by four'
	sónó 'five'	sósónó 'five by five'
	sóniá 'six'	sósóniá 'six by six'

For numerals 7 and above, all the syllables of the cardinal numeral are reduplicated. However, for 100, both the partially and totally reduplicated forms are acceptable.

36.	Cardinal numeral	Distributive numeral
	sónómà '7'	sónómà sónómà '7 by 7'
	nínì '8'	nínì nínì '8 by 8'
	ísíéní '9'	ísíéní ísíéní '9 by 9'
	ójí '10'	ójí ójí '10 by 10'
	sí '20'	sí sí '20 by 20'
	sí ná ójí ná '30'	sí ná ójí ná sí ná ójí ná '30 by 30'
	sónòà sì '100'	sónòà sì sónòà sì '100 by 100'
		(total reduplication)
		sósónòà sì '100 by 100'
		(partial reduplication)
	óḡḡ '400'	óḡḡ óḡḡ '400 by 400'

Distributive numerals may modify the noun phrase where they occur in the phrase-final position as seen in the sentences below.

37. námá má jòkò màmàmì wá áru m 'ké sùdò
 animal PL all two by two AUX boat the LOC enter
 'All the animals entered the boat two by two (in twos)'
38. wá kìnì jòkò gbógbóri 'ké ómú àmíḡ làá
 1PL person all one by one LOC go there reach/arrive
 'All of us arrived there one by one'.
39. áru má wó tátárú wá túú
 boat PL SM three by three AUX push in
 'The boats landed three by three (in threes)'.

-
40. áru má wó mààmàni wá súú 6ó
 boat PL SM two by two AUX enter come
 'The boats came in two by two (in twos)'.

4. Conclusion

This study has given a description of the Nkɔrɔɔ numeral system by discussing the derivation of three types of numerals - cardinal, ordinal and distributive. Both morphological processes and arithmetic methods are used in deriving Nkɔrɔɔ numerals. The cardinal and ordinal numerals are derived via the morphological process of compounding. In addition, the cardinal numerals also employ the arithmetic methods of multiplication, subtraction and addition while the distributive numerals are derived via reduplication. The study also discusses the tonal changes that occur when ordinal numerals function as prenominal modifiers. The nouns generally take on a HL tone pattern after ordinal numerals that end in high tones and a LL tone pattern after ordinal numerals that end in a low tone. As part of an ongoing grammatical description, it is hoped that this study will aid in the documentation of this endangered minority language.

Abbreviations

+	morpheme boundary
=	clitic boundary
AUX	auxiliary verb
HH	high-high tone pattern
HL	high-low tone pattern
LOC	locative morpheme
LH	low-high tone pattern
LL	low-low tone pattern
PCL	plural clitic
PL	plural marker
SM	subject marker
1PL	1 st person plural pronoun

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Òkọ Numerals and their Derivation*

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This paper is a part of my on-going work on the documentation of Ọkọ, a lesser described West Benue-Congo language (Williamson & Blench 2000). The language is spoken by the Ogori/Magongo people of Kogi State, North-Central Nigeria. The numeral system of Ọkọ is the most endangered aspect of the language. This is so because, the act of counting in Ọkọ has been left to older members of the community, while the younger generation prefers to express numerals in the English language during speech. Ọkọ belongs to the group of languages which has a vigesimal numeral system (Armstrong 1962, Comrie 2005). However, it is observed that though the numeral system of Ọkọ is in the base of twenty, the actual counting is done in tens. The main objective of this study is to contribute to the documentation of this most vulnerable aspect of the language by providing a detailed description of its numeral system. In carrying out this task, I draw from phonological, morphological and syntactic processes that yield several numeral forms. For instance, at the phonological level, processes such segment elision, assimilation and sometimes coalescence are required in the derivation of some numeral forms. At the morphological level, some numeral forms are derived by affixation or compounding or by reduplication. And at the syntactic level, some numeral forms have sentential expressions.

1. Introduction

Numerals in Ọkọ can be counted from ‘one’ to ‘one thousand’ and more. However, the ability to count by native speakers varies from person to person due to varying degrees of language proficiency. Speakers more often tend to shy away from numerals. An average speaker is well at home in every other aspect of his language but numerals. This seems to be a common phenomenon across most African communities especially in such communities where the English language is used side by side with the language of the communities. In the case of Ọkọ, the task of counting in the language is left with older folks, as most members of the community, especially the younger generations prefer to count in the English language, not even in Yorùbá, another commonly used language in the Ọkọ speaking communities. An average speaker of Ọkọ can comfortably count from 1 – 20; anything beyond this may be regarded as complex. From this observation, one realizes that one aspect of the language which seems to be disappearing faster than other aspects is the numeral system. All numerals like nouns in Ọkọ begin with vowel.

In the presentation of data in this work, I make use of the standard orthography of Ọkọ, and not the IPA symbols. Below is a list of some consonants and vowels which have been modified:

1.	Phonetic Symbol	Orthography
	consonants	
	ɲ	ny
	ʃ	ʃ
	j	y
	ɖ	j
	vowels	
	ɛ	ẹ
	ɔ	ọ

Secondly, with respect to tone marks, the acute accent [´] on a tone-bearing segment, usually a vowel (syllabic consonants do not usually occur in the language; they are only attested in loanwords) represents a high tone, all instances where any particular vowel is not tone marked represents the mid tone, and the grave accent [̀] on any tone-bearing segment represents a low tone.

2. Cardinal numerals

Òkọ belongs to the group of languages that have a vigesimal numeral system. This means that counting is done in the base of twenty (Armstrong 1962, Comrie 2005). The form of the first ten numerals comprises of those derived from simple roots and those that are derived through compounding. Numbers 1-5, 8 and 10 are simple roots, while numbers ‘6’, ‘7’ and ‘9’ are derived by compounding. For instance, the numeral **òpónòọ́rẹ** ‘6’ is derived by compounding the roots **ùpí** ‘five’ and **òọ́rẹ** ‘one’. Also, the numeral **úfóm̀bòrẹ** ‘seven’ includes an unidentified morpheme **úfóm̀** and the morpheme **ẹ̀bòrẹ** ‘two’. In the derivation of **ùbò̀òrẹ** ‘nine’, we have the diminutive morpheme **úbá** added to the numeral **òọ́rẹ** ‘one’, referring to a number which is less than ‘one’, that is, the number ‘10’. In actual sense, **ùbò̀òrẹ** ‘nine’ is the clipped form of the clausal structure in (1).

2. **úbá-òọ́rẹ è gúlẹ ẹ̀fọ**
 DM¹-one 3SG complete ten
 ‘ten is less than one’

3.	ọ̀yẹ̀rẹ/òẹ̀rẹ	‘1’	òpónòọ́rẹ	‘6’
	ẹ̀bòrẹ	‘2’	úfóm̀bòrẹ	‘7’
	ẹ̀ta	‘3’	ònókónókónọ	‘8’

¹ Diminutive morpheme

èna	‘4’	ùbòrè	‘9’
ùpi	‘5’	èfọ	‘10’

Beyond the first ten numbers, the contracted form of the conjunction **akà** ‘and’, minus the first vowel, to realize **-kà**, is used to add relevant numbers to ten, up to nineteen, and from twenty-one upwards. Because vowel elision processes in Òkọ is always regressive whereby the first of two vowels at a boundary is always elided, the linker **-ka**, loses its only surviving vowel, /a/, to the first vowel of the conjoined numeral. We reemphasize the claim that all numerals like all nouns in Òkọ have V-initial.

4.	èfọkòyèrè	‘11’	èfọkòpónọrè	‘16’
	èfọkèbòrè	‘12’	èfọkùfòmbòrè	‘17’
	èfọkèta	‘13’	èfọkònókònókònọ	‘18’
	èfọkèná	‘14’	èfọkùbòrè	‘19’
	èfọkùpi	‘15’		

The numeral **ògbọlọ** ‘20’ consists of a simple root. Numeral junctions of the multiples of twenty, (i.e. forty, sixty, eighty and one hundred) are derived by attaching the pre-root vowel **i-**, to a relevant root. Numerals such as **íbòrè** ‘forty’ and **íta** ‘sixty’ and **ípì** ‘one hundred’ are derived by attaching the **i-** pre-root to **èbòrè** ‘two’, **èta** ‘three’ and **ùpi** ‘five’ respectively.

5.	èbòrè	‘2’	í-bòrè	‘40’
	èta	‘3’	í-ta	‘60’
	ùpi	‘5’	í-pì	‘100’

However, in the derivation of **ìgbófú** ‘eighty’ the pre-root **i-** is attached to the suppletive morpheme **-gbófú**, which is not morphologically related to **èna** ‘four’. We assume that the pre-root vowel **i-** multiplies any given root by twenty.

Although the numeral system of Òkọ is in the base of twenty, the actual counting is done in tens. Odd numeral junctions such as, **ògbọlọkààkọrọfọ** ‘thirty’, **íbòrèkààkọrọfọ** ‘fifty’, **ítakààkọrọfọ** ‘seventy’, and **ìgbófúkààkọrọfọ** ‘ninety’, are derived by combining **èfọ** ‘ten’ to multiples of twenty using a clausal expression

6. **kà-à-karẹ èfọ**
 CONJ-3SG-surpass ten
 ‘and it surpasses by ten’

7.	<i>Numeral Stem</i>		<i>Derived Numeral</i>	
	ógbọlọ	‘20’	ógbọlọkààkọrọfọ	‘30’
	íbọrẹ	‘40’	íbọrẹkààkọrọfọ	‘50’
	íta	‘60’	ítakààkọrọfọ	‘70’
	ìgbófú	‘80’	ìgbófúkààkọrọfọ	‘90’

We note in (7) that several phonological processes are involved in the derivation of the numerals. The first is the coalescing effect where two identical contiguous vowels at word boundary coalesce into a non-identical vowel $\text{ẹ} \# \text{ẹ} \rightarrow \text{ọ}$. This is followed by the spreading effect where the back vowel which is the product of the coalescing process spreads its features to the vowel in the preceding adjacent syllable. Finally, there is the tone stability effect in which the low tone survives the coalescence process.

8.	<i>Coalescence effect</i>		<i>Spreading effect</i>		<i>Tone stability effect</i>
	kare ẹfọ	→	karọfọ	→	kọrọfọ

The derivation of numerals such as 21, 31, 41, 51, 61, 71, 81 and 91, have a slightly different morphological realization. The number ‘1’ in Ọkọ has four different forms, depending on its function. For instance, as a cardinal numeral, its form may either be òyéřẹ or òěřẹ; but when conjoined to multiples of ten, example, 20, 30, 40 50 etc, it is expressed as ùtó.

Example:

9. **ógbọlọ-kà-ùtó**
 Twenty-and-one

The vowel of the conjunction morpheme as usual gets elided, and the structure becomes for examples, **ógbọlọkùtó** ‘twenty-one’.

10.	ógbọlọkùtó	‘21’	ítakùtó	‘61’
	ógbọlọkààkọrọfọkùtó	‘31’	ítakààkọrọfọkùtó	‘71’
	íbọrẹkùtó	‘41’	ìgbófúkùtó	‘81’
	íbọrẹkààkọrọfọkùtó	‘51’	ìgbófúkààkọrọfọkùtó	‘91’

Adding other numerals, from ‘2’ to ‘9’ to relevant numeral stems involves a sentential expression.

11.	ógbọ̀lọ̀kẹ̀tẹ̀bọ̀rẹ̀	‘22’	ógbọ̀lọ̀kẹ̀tọ̀pọ̀nọ̀ọ̀rẹ̀	‘26’
	ógbọ̀lọ̀kẹ̀tẹ̀ẹ̀ta	‘23’	ógbọ̀lọ̀kẹ̀túfọ̀mbọ̀rẹ̀	‘27’
	ógbọ̀lọ̀kẹ̀tẹ̀ẹ̀na	‘24’	ógbọ̀lọ̀kẹ̀tọ̀nọ̀kọ̀nọ̀kọ̀nọ̀	‘28’
	ógbọ̀lọ̀kẹ̀tùùpi	‘25’	ógbọ̀lọ̀kẹ̀túbọ̀rẹ̀	‘29’

The numerals in the examples in (11), though lexicalized, have a sentential reading. For example, numbers ‘22’ and ‘36’, like others are derived from the same syntactic structure.

12. ógbọ̀lọ̀ -kà è tó ẹ̀bọ̀rẹ̀ ‘Twenty two’
 twenty CONJ 3SG.S meet two
 ‘Twenty and it meet two’
13. ógbọ̀lọ̀kààkọ̀rọ̀fọ̀ -kà è tó ọ̀pọ̀nọ̀ọ̀rẹ̀ ‘Thirty six’
 thirty CONJ 3SG.S meet six
 ‘Thirty and it meet six’

Several phonological processes such as vowel elision and assimilation, and tone modifications are also involved in the derivation of the numerals in (11). The contracted form of the conjunction morpheme **-kV-**, links the relevant numeral stem to a verb phrase which is headed by the verb **tó** ‘to meet’, followed by a numeral object. The vowel of the verb root may assimilate the contiguous vowel of the numeral object or may be elided before the contiguous vowel of the numeral object. There is no clear-cut condition(s) that determine whether assimilation or elision in any case.

14. *Assimilation*

ógbọ̀lọ̀-kẹ̀-tó-ẹ̀ta	→	ógbọ̀lọ̀kẹ̀tẹ̀ẹ̀ta	‘23’
ógbọ̀lọ̀-kẹ̀-tó-ẹ̀na	→	ógbọ̀lọ̀kẹ̀tẹ̀ẹ̀na	‘24’
ógbọ̀lọ̀-kẹ̀-tó-ùpi	→	ógbọ̀lọ̀kẹ̀tùùpi	‘25’
ógbọ̀lọ̀-kẹ̀-tó-ọ̀pọ̀nọ̀ọ̀rẹ̀	→	ógbọ̀lọ̀kẹ̀tọ̀pọ̀nọ̀ọ̀rẹ̀	‘26’
ógbọ̀lọ̀-kẹ̀-tó-ọ̀nọ̀kọ̀nọ̀kọ̀nọ̀	→	ógbọ̀lọ̀kẹ̀tọ̀nọ̀kọ̀nọ̀kọ̀nọ̀	‘28’

15. *Elision*

ógbọ̀lọ̀-kẹ̀-tó-ẹ̀bọ̀rẹ̀	→	ógbọ̀lọ̀kẹ̀tẹ̀bọ̀rẹ̀	‘22’
ógbọ̀lọ̀-kẹ̀-tó-úfọ̀mbọ̀rẹ̀	→	ógbọ̀lọ̀kẹ̀túfọ̀mbọ̀rẹ̀	‘27’
ógbọ̀lọ̀-kẹ̀-tó-úbọ̀rẹ̀	→	ógbọ̀lọ̀kẹ̀túbọ̀rẹ̀	‘29’

Numerals of the multiples of 200, such as 400, 600 and 800 comprise of their respective stems, while numerals of the multiples of 100, such as 300, 500, 700, and

900 are derived by compounding the root **ípì** ‘one hundred’ to the relevant multiples of 200 with the aid of the conjunction morpheme **–kV**, where V is identical with the high front vowel which it precedes.

16. ẹpare	200	ẹparekìípi	300
ífupi	400	ífupikìípi	500
àkàta	600	àkàtakìípi	700
ífúrufọ	800	ífúrufọkìípi	900

The numeral **ífúrufọkẹẹpare** ‘one thousand’ is derived by combining **ífúrufọ** ‘eight hundred’ with **ẹpare** ‘two hundred’ by the aid of the conjunction **–kv**.

17. **ífúrufọkẹẹpare** ‘1000’

3. Ordinal Numerals

Ordinal numerals in Òkọ are derived from cardinal ones by attaching the suffix **–ro** to a cardinal number. Here, we encounter another form of the number ‘1’ in Òkọ, **òşoò-ro**. Òkọ can be categorized under languages in which ‘first’ is suppletive, derivationally independent of ‘one’ (see Stolz and Veselinova 2005:218). Other numerals from ‘two’ upwards are derived by attaching the suffix **–ro** to relevant cardinal numerals.

18. ọyẹre/ọẹre	‘1’	oşooro	‘1 st ’
ẹbọrẹ	‘2’	ọọbọrẹrò	‘2 nd ’
ẹta	‘3’	ẹtẹtaro	‘3 rd ’
ẹná	‘4’	ọnenàrò	‘4 th ’
ùpi	‘5’	ùpiro	‘5 th ’
ọpọnọọre	‘6’	ọpọnọọrerò	‘6 th ’
úfọmbọrẹ	‘7’	úfọmbọrẹrò	‘7 th ’
ọnọkọnọkọnọ	‘8’	ọnọkọnọkọnọro	‘8 th ’
ùbọrẹ	‘9’	ùbọrẹrò	‘9 th ’
ẹfọ	‘10’	ẹfọro	‘10 th ’
ẹfọkọẹre	‘11’	ẹfọkọẹrerò	‘11 th ’
ẹfọkẹbọrẹ	‘12’	ẹfọkẹbọrẹrò	‘12 th ’
ẹfọkẹta	‘13’	ẹfọkẹtarò	‘13 th ’

ẹfọkẹná	‘14’	ẹfọkẹnáro	‘14 th ’
ẹfọkùpi	‘15’	ẹfọkùpiro	‘15 th ’
ẹfọkòpónọọrẹ	‘16’	ẹfọkòpónọọrẹro	‘16 th ’
ẹfọkùfọmbọrẹ	‘17’	ẹfọkùfọmbọrẹro	‘17 th ’
ẹfọkònókònókònọ	‘18’	ẹfọkònókònókònọro	‘18 th ’
ẹfọkùbọrẹ	‘19’	ẹfọkùbọrẹro	‘19 th ’
ógbọlọ	‘20’	ógbọlọro	‘20 th ’

The main function of ordinal numerals in Òkọ is to indentify ranks within a hierarchy, to situate a noun referent in a particular hierarchical position. For example, a number like **úfọmbọrẹrẹ** ‘7th’ refers to an entity which is positioned as the seventh.

An ordinal numeral may also function as a noun phrase by itself or may modify a noun within a noun phrase.

19. **Òfọbọrẹrẹ fò ógbén yọ emumu-ùbo**

two.AGT carry child go book-house

‘The second took the child to the school’

20. **Órọrìrẹ àyẹ nwán ọnẹ nẹnẹ wà úfọmbọrẹrẹ**

Hunter DEF.SG kill this REL be **seven.AGT**

‘The hunter killed the seventh’

21. **Úbó ẹtẹtáró nẹnẹ Akin mán na àyẹ è wó ẹrẹn**

House **three.AGT** REL Akin build DSM² 3SG.I 3.SG.S LOC front

‘The third house which Ade built is right ahead’

4. Distributive Numerals

Distributive numerals in Òkọ are derived from cardinal numerals either through total or partial reduplication. In cardinal numerals listed from 1-10, the numeral **ọyẹrẹ/ọọrẹ** ‘one’ can only be partially reduplicated as **ọọrọọrẹ** in its distributive form. Others such as **ẹta** ‘three’ and **ẹna** ‘four’ can have partial or completely reduplicated forms, **ẹtẹta** or **ẹta-ẹta**, and **ẹnẹna** or **ẹna-ẹna** in their distributive forms. The remaining numbers, ‘2’, ‘5’, ‘6’, ‘7’, ‘8’, ‘9’ and ‘10’, can only have their cardinal forms completely reduplicated in order to derive their distributive forms.

² Discourse marker,

22.	Base stem	Partial	Total	
	òyére/òére	òóròrè	-	‘one-by-one’
	ẹbòrè	-	ẹbòrè-ẹbòrè	‘two-by-two’
	ẹta	ẹtẹta	ẹta-ẹta	‘three-by-three’
	ẹná	ẹnẹna	ẹna-ẹna	‘four-by-four’
	ùpi	-	ùpi-ùpi	‘five-by-five’
	òpónòóre	-	òpónòóre-òpónòóre	‘six-by-six’
	úfòmbòrè	-	úfòmbòrè-úfòmbòrè	‘seven-by-seven’
	ònókónókónọ	-	ònókónókónọ-ònókónókónọ	‘eight-by-eight’
	ùbòrè	-	ùbòrè-ùbòrè	‘nine-by-nine’
	ẹfọ	-	ẹfọ-ẹfọ	‘ten-by-ten’

Distributive numerals usually occur within a noun phrase in any position of a sentence.

23. Égbén ábẹ fọ oti àbẹ ẹtẹta
 Children DEF.PL carry stick DEF.PL DISTR-three
 ‘The children carried the sticks in threes’
24. Àde rọwa úrúnmù àyẹ nẹ tọ ẹbòrè-ẹbòrè
 Ade divide orange DEF.SG give 1PL.O DISTR-two
 ‘Ade divided the oranges among us two per person’
25. Bẹ sẹ bì-íwú ẹfọ-ẹfọ
 They catch 3PL.POSS.body DISTR-ten
 ‘They grouped themselves in tens’

5. Adjectival Numerals

In some languages there is a difference in form between cardinal numerals and adjectival numerals. Example of such is Yorùbá (Armstrong 1962).

26. **Yorùbá**
- | Cardinal | Adjectival | Gloss |
|----------|------------|-------|
| ọkan | kan | ‘1’ |
| ẹjì | méjì | ‘2’ |
| ẹta | mẹta | ‘3’ |
| ẹrin | mẹrin | ‘4’ |
| àrún | márùún | ‘5’ |

27. orí kan
head one
'one head'

28. Ọmọ méjì ni Adé bí
Child two FOC Ade born
'Ade has fathered two children'

On the other hand are languages which do not show any difference in form between cardinal numerals and adjectival numerals. Ọkọ belongs to this group. We will recall that in (§ 2), two forms of the number ọ̀yẹ̀rẹ̀/ọ̀ọ̀rẹ̀ '1', are identified. However when the number '1' occurs as an adjectival, only the ọ̀ọ̀rẹ̀ form can be used.

29. **Ọkọ**

<i>Cardinal</i>	<i>Adjectival</i>	<i>Gloss</i>
ọ̀yẹ̀rẹ̀/ọ̀ọ̀rẹ̀	ọ̀ọ̀rẹ̀	'1'
ẹ̀bọ̀rẹ̀	ẹ̀bọ̀rẹ̀	'2'
ẹ̀ta	ẹ̀ta	'3'
ẹ̀na	ẹ̀na	'4'
ùpí	ùpí	'5'
ọ̀pọ̀nọ̀ọ̀rẹ̀	ọ̀pọ̀nọ̀ọ̀rẹ̀	'6'
úfọ̀mbọ̀rẹ̀	úfọ̀mbọ̀rẹ̀	'7'
ọ̀nọ̀kọ̀nọ̀kọ̀nọ̀	ọ̀nọ̀kọ̀nọ̀kọ̀nọ̀	'8'
ùbọ̀rẹ̀	ùbọ̀rẹ̀	'9'
ẹ̀fọ̀	ẹ̀fọ̀	'10'

30. ótí ọ̀ọ̀rẹ̀
stick one
'one stick'

31. éró ẹ̀ta
people three
'three people'

32. égbén ẹ̀bọ̀rẹ̀ ọ̀sa ẹ̀kọ̀
children two come here
'two children came here'

6. Conclusion

The pupose of this study has been to give a description of the numeral system of Òkọ. We have examined numeral forms in this lesser described language and the several processes that are involved in their derivation. This is an ongoing work. It is hoped that subsequent research into the numeral system of this language will include discussions on the expression of some arithmetic operations such as: fractions, addition, subtraction, division, etc.

Note

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The Fulfulde Numeral System

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The work examines the Fulfulde counting system. Two related tasks are carried out in this endeavour, First, an attempt is made to make bare the systematic organization of the Fulfulde numerals, and second, the numerals are further subjected to linguistic analysis. The overall aim is to determine the linguistic properties, processes or operations exploited by Fulfulde in the various permutations and combinations that characterized the language's counting system. Furthermore, a preliminary investigation has shown the numeral system of Fulfulde is severally endangered as children within the age-bracket of 5-7 years can only count 1-10, whereas those that fall within the range of 7-12 years could only count up to 20. Regrettably, the rest of the numerals are produced by making recourse to Hausa numerals. Perhaps, this is a clear case of an on-going process of language shift.

1. General Remarks

The present study is essentially a preliminary investigation and analysis of the linguistic structure of Fulfulde² counting system. Preliminary investigation has shown that the numeral system of Fulfulde is the most endangered aspect of the language. This may not be unconnected with the fact that the counting system is complex, and more importantly, that the language is threatened due to the forces of language shift. Two different but related tasks are carried out here: first and foremost, an attempt is made to make bare the systematic organization of the Fulfulde numerals and second, these numerals are further subjected to linguistic analysis. The overall aim is to identify and determine the linguistic properties, processes or operations exploited by Fulfulde in the various possible permutations and combinations that typically characterized the counting mechanism of the language.

In order to put our discussion in proper perspectives, the rest of the paper is organized as follows. The linguistic identity of Fulfulde and a brief geo-historical distribution of Fulfulde people is presented in section 1.1. Section 2 deals with the cardinals coupled with their derivatives, the ordinals as well as the linguistic properties evident in them. The system of distributive numerals and multiples are the subject matter of section 3 and 4, this is done with a view to identify the prototypical linguistic properties and operations associated with these sets of counting mechanism. We conclude our discussion in section 5.

1.1 The Linguistic Credentials of Fulfulde and its Geo-historical Antecedents

Fulfulde belongs to the West Atlantic branch of the Congo- Kordofanian languages. In Senegal and Guinea, the language is called Pulaar and Pular, respectively. It is stated

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in the literature that the Fulani are an ethnic group of people spread over several countries, predominantly in West Africa, but found also in Central Africa and Sudanese North Africa. The countries in Africa that are homes to Fulfulde speakers include Mauritania, Senegal, Guinea, The Gambia, Mali, Nigeria, Sierra Leone, Benin, Burkina Faso, Guinea Bissau, Cameroon, Côte d'Ivoire, Niger, Chad, Togo, the Central African Republic, Ghana, Liberia, and as far as Sudan in the east. They are differently referred to by names such as Haalpulaar'en, Fula, Fulbe, Peul, Fulani, and Fellata. Several Fulfulde dialect continuum have names, locations, and general definitions that are more or less generally agreed upon by linguists, anthropologists, and others. These include the Halpulaar'en of Senegal (Fouta Toro), Pulaar of Guinea (Futa Djallon), Fulfulde of Maasina, Fulfulde of Nigeria, and the Fulfulde of Adamawa highlands in Cameroon and eastern Nigeria. These are considered to be the principal dialects of Fulfulde. Historically these were areas of Fulani political dominance at some point; today they constitute part of modern West African nations characterized by a large Fulani population. While some scholars have speculated over the origin of Fulani people, current linguistic and genetic evidence suggests an indigenous West African origin, most closely related to that of the Wolof and Serer ethnic groups. Historical and archaeological records indicate that Peul-speakers have resided in western Africa since at least the 5th century A.D, as well. The Fulani are traditionally a nomadic, pastoralist, trading people, herding cattle, sheep, and goats across the vast dry hinterlands of their domain, keeping somewhat separate from the local agricultural populations.

Fulfulde is spoken widely by nomadic and semi-nomadic Fulani in North-Western, North-Eastern and North-Central parts of Nigeria. It is used alongside Hausa, by settled Fulani in towns and villages across the former Northern Nigeria. In Adamawa Fulfulde is also used to some extent as a Lingua Franca by non-Fulani as well as by Fulani.

Arnott (1969) stated that three main varieties or dialects may be distinguished viz. Sokoto, Adamawa and the central Northern Nigeria.

Fulfulde is said to be a stress language. Its consonants exhibit voicing opposition, and they may be preceded by glottalisation or nasalisation (cf. *mb*, *nd*, *nj*, *ng*). Vowels show the contrast between long and short. An important feature is the morphophonemic alternation of initial consonants in singular and plural forms (e.g., *w-* *b-* *mb*, *r-d-nd*, *s-c*, and *f-p*). Fulfulde has a highly developed system of more than 20 nominal classes that governs agreement between nouns and attributive forms (adjectives, numerals, participles, demonstratives, possessives, and articles) and anaphoric forms (pronouns). Noun classes are distinguished by suffixes and by the degree of alternation of the initial consonant. The verb is marked for voice (active, medial and passive) and forms, for instance, causation, intensity, instrumentality, reciprocity, and simulation of action. The language is also characterized by a highly developed system of forms specifying tense and aspect. Aspectual opposition is expressed in pronouns in subject position. However, negative forms obey a special paradigm (Arnott, 1970).

Fulfulde operates a non- decimal counting system that is based on base-five. These basic digits together with other cardinals generate both simple and complex number patterns as we shall see in the sections and subsections below.

2. The Cardinals and their Derivatives in Fulfulde

Within the scheme of Fulfulde numeration, the cardinal digits 1 to 5 as well as 10 are lexicalized. However, the rest of the cardinals, with the exception of 10, (i.e., the digits 6 through 9) are derived by an additive operation that adds 1 to 5 to produce 6. In the same vein, to generate 7, 8, and 9, numerals 2, 3, and 4 are added to cardinal 5, respectively. But there is a separate lexical item for 10: *sappo*. The entire numerical arrangement can be argued to depict a trichotomous morphological structure with a gradation from simple to complex and more complex numeration framework, especially in the derived segment. A detailed account of this is presented in due course. Let us begin by examining the cardinals and their derivatives, as encoded in the lexicon, vis-à-vis their concomitant idiosyncratic linguistic properties.

2.1 The Cardinals in Fulfulde

The Fulfulde numeral system has the following cardinals as its basic numerals:

1a)	go'o	1
	didi	2
	tati	3
	nayi	4
	joyi	5
b.	jowe go'o	6
	jowe didi	7
	jowe tati	8
	jowe nayi	9
	sappo	10

A cursory look at the above paradigm reveals two derivational patterns: the cardinals 1- 5 are lexicalized by means of a single lexeme; whereas the digits 6 to 9 are derived by operating a base five pattern successively added to 1 to 4, to respectively produce 6, 7, 8, and 9. Note the consonant and vowel change in the lexical items for 5 in the basic and derived cardinals, respectively. The number 10 is represented by the lexical item *sappo*. The consonant *y* changes to *w* with the consequent change in the vowel *i* realized as *e* in the derived forms (1b) above. Again, there is no conjoining particle between the number 5 plus the cardinals 1 to 4 (i.e., 5+1, 5+2, 5+3, and 5+4 which equals 6, 7, 8 and 9 respectively). But rather the numerals are juxtaposed. This is contrary to what is realized in the next set of derivatives where the cardinals 1 to 4 are successively added to 10 by means of the conjoining particle *i* to 10 to yield, successively, 11, 12, 13, 14 and 15.

This invariably means there are no separate single lexical items for 11, 12, 13 14, and 15 in Fulfulde. A different linguistic scenario obtains in respect of Complex Derived Numbers, where a conjoining particle *i* operates to derive numerals upward of 10 to 19 in the first instance, as earlier noted. This complex number pattern is displayed in (2.2) below.

2.2 The Fulfulde Complex Derived Numerals

- 2)a. sappo i go'o → 10 and 1 = 11
 sappo i dīdī → 10 and 2 = 12
 sappo i tati → 10 and 3 = 13
 sappo i nayi → 10 and 4 = 14
 sappo i joyi → 10 and 5 = 15
- b. sappo i jowe go'o → 10 and 5 + 1 = 16
 sappo i jowe dīdī → 10 and 5 + 2 = 17
 sappo i jowe tati → 10 and 5 + 3 = 18
 sappo i jowe nayi → 10 and 5 + 4 = 19
 chappande dīdī / laso → one 20 or laso

Note the complexity in the formations of 10 to 20. 11 to 15, simply requires the productive conjunct *i* that signifies 'and'. Even though the same element is used in the case of 16 through 19, the latter set differs from the former one significantly. The set of numbers 11 to 15 employs only one order operation (i.e., recursive use of the conjoining particle *i*; while in the case of 16 to 19 there is a second order operation exploited- the successive juxtaposition of 5 immediately followed by the cardinals 1 to 4. This demonstrates the fact that the latter set of numbers depicts some computational complexity. In the case of the number 20, it is realized both as a derived form and as a single lexical item. The derived form shows a post- modification of the number. That is to say the number 1 to 5 etc, signifying various quantities follows 20 rather than precedes it. Let us examine the realization of 21 to 29 to see how they are formed in the language.

2.4 The Formation of Numerals 21 - 29

- (3) chappande dīdī i go'o/ laso i go'o → 2 tens and 1 = 21 or 20 and 1
 chappande dīdī i dīdī/ laso i dīdī → 2 tens and 2 = 22 or 20 and 2
 chappande dīdī i tati/ laso i tati → 2 tens and 3 = 23 or 20 and 3
 chappande dīdī i nayi/ laso i nayi → 2 tens and 4 = 24 or 20 and 4
 chappande dīdī i joyi/ laso i joyi → 2 tens and 5 = 25 or 20 and 5
 chappande dīdī i jowe go'o/ laso i jowe go'o → 2 tens and 5 + 1 = 26
 or 2 tens and 5, 1.
 chappande dīdī i jowe dīdī/ laso i jowe dīdī → 2 tens and 5 + 2 = 27
 or 2 tens and 5, 2.
 chappande dīdī i jowe tati/ laso i jowe tati → 2 tens and 5 + 3 = 28
 or 2 tens and 5, 3.

chappande didi i jowe nayi/ laso i jowe nayi	→ 2 tens and 5 + 4 = 29 or 2 tens and 5, 4.
chappande tati	→ 3 tens = 30

An examination of the above data reveals another complex set of number derivation characterized by free variation that suggests alternative ways of computation in the language. The first expression in each minimal pair of numbers above, there is a repetitive use of *chappande* which also signifies ten (10) (cf. *sappo* above) and is productively used as multiples of ten, upwards of twenty through fifty; including the derivations of the intermediate numbers. This then suggests the fact that *chappande* is much more productive than *lasso*: notes the possibilities of *chappande didi*, *chappande tati*, *chappande nayi*, *chappande joyi* but never **lasso didi*, **lasso tati*, **lasso nayi* and **lasso joyi*. This is perhaps because *lasso* represents yet another computational system that is based on 20 as we shall see, shortly, in the next set of numbers and number patterns.

2.5 Multiples of Tens and Twenties in Fulfulde

The multiples include the following:

(4) chappande didi/ laso	→	2 tens = 20
chappande tati	→	3 tens = 30
chappande nayi/ lasoji didi	→	4 tens = 40
chappande joyi	→	5 tens = 50
chappande jowe go'o/ lasoji tati	→	5 tens, 1 ten/ 2 twenties = 60
chappande jowe didi/ _____	→	5 tens, 2 tens/ _____ = 70
chappande jowe tati/ lasoji nayi	→	5 tens, 3 tens/ 4 twenties = 80
chappande jowe nayi/ _____	→	5 tens, 4 tens/ _____ = 90
hemre	→	one hundred = 100

There are interesting numerical properties that characterized (4): first and foremost, the lexical item *chappande* that represents 10 normally premodifies the cardinals 2, 3, 4 and 5 that stand for the multiples, contrary to the ordering in English. Thus, we have 'ten 2'; 'ten 3'; 'ten 4' and 'ten 5' instead of '2 tens'; '3 tens'; '4 tens' and '5 tens' respectively. Second, there are gaps in respect of *lasoji*, where the multiples are odd and not even numbers. Third, after number 50 the rest of the multiples are derived by the use of *chappande* and the reoccurring 5 (signifying 5 tens), and cardinals 1 to 4 to derive multiples of 10 other than 50. However, there is a separate lexical entity for 100.

2.6 Deriving Intermediate Numbers: 31 - 99

Intermediate integers that fall within 31 and 99 excluding the multiples of ten follows the same process of derivation we observed in numerals 21 to 29. To derive any intermediate number, three-order operation is required. First, *chappande* is used to signify the number of tens, followed by *jowe* for 5 tens and immediately followed by

any cardinal between 1 to 4 which also represents additional multiple of tens added to the first 5 tens. This suggests a complex numerical derivational pattern. The same derivational process applies to the use of *lasoji*.

2.7 The Composition of Hundreds and intermediate Integers in Fulfulde

It appears the same productive operations observed in the preceding sections are also exploited in computing hundreds, multiple of hundreds and the intermediate numbers that lie in between. Let us first present the numbers and their respective lexical identities:

(5) hemre	→	100		
hemre i go'o	→	100 and 1	=	101
hemre i dīdi	→	100 and 2	=	102
hemre i tati	→	100 and 3	=	103
hemre i nayi	→	100 and 4	=	104
hemre i joyi	→	100 and 5	=	105
hemre i jowe go'o	→	100 and 5, 1	=	106
hemre i jowe dīdi	→	100 and 5, 2	=	107
hemre i jowe tati	→	100 and 5, 3	=	108
hemre i jowe nayi	→	100 and 5, 4	=	109
hemre i sappo	→	100 and 10	=	110
hemre i sappo go'o	→	100 and 10, 1	=	111
hemre i sappo dīdi	→	100 and 10, 2	=	112
hemre i sappo tati	→	100 and 10, 3	=	113
hemre i sappo nayi	→	100 and 10, 4	=	114
hemre i sappo joyi	→	100 and 10, 5	=	115
hemre i sappo jowe go'o	→	100 and 10, 5, 1 (100 and 10+5+1)	=	116
hemre i sappo jowe dīdi	→	100 and 10, 5, 2 (100 and 10+5+2)	=	117
hemre i sappo jowe tati	→	100 and 10, 5, 3 (100 and 10+5+3)	=	118
hemre i sappo jowe nayi	→	100 and 10, 5, 4 (100 and 10+5+4)	=	119
hemre i chappande dīdi/hemre i laso	→	100 and 2 tens/ 100 and 20	=	120
hemre i chappande tati	→	100 and 3 tens	=	130
hemre i chappande nayi/hemre i lasoji dīdi	→	100 and 4 tens/100 and two 20	=	140
hemre i chappande joyi	→	100 and 5 tens	=	150
hemre i chappande jowe go'o/hemre i lasoji tati	→	100 and 5 tens, 1 ten /100 and 3 twenties	=	160
hemre i chappande jowe dīdi	→	100 and 5 tens, 2 tens	=	170
hemre i chappande jowe tati/ hemre i lasoji nayi	→	100 and 5 tens, 3 tens/100 and 4 twenties	=	180
hemre i chappande jowe nayi	→	100 and 5 tens, 4 tens	=	190
keme dīdd	→	100, 2 (= 2 hundreds)	=	200
keme tati	→	100, 3 (= 3 hundreds)	=	300
keme nayi	→	100, 4 (= 4 hundreds)	=	400
keme joyi	→	100, 5 (= 5 hundreds)	=	500

keme jowe go'o	→	100, 5, 1 (=6 hundreds)	= 600
keme jowe didi	→	100, 5, 2 (= 7 hundreds)	= 700
keme jowe tati	→	100, 5, 3 (= 8 hundreds)	= 800
keme jowe nayi	→	100, 5, 4 (= 9 hundreds)	= 900
ujineere	→	1000	

The above paradigm presents yet another interesting scenario and does not pose a contrast to those we have earlier discussed, particularly in respect of multiples of hundred. These numerals appear to a large degree to obey the same computational principles that operate in the preceding cases. A major similarity between hundreds and upwards of 500 resides in the fact that all the relevant numbers in their ascending magnitudes within a particular number, such as 600, are juxtaposed to one another and the normal reoccurring conjoining particle *i* is never used. Note that we have observed the same formations in the aforementioned instances. Perhaps an interesting phenomenon worthy of note is the fact that in deriving 200 and above, *keme* and not *hemre* is employed. We have thus far, discussed the cardinals and their derivatives in Fulfulde, we now consider the ordinals.

3. The Ordinals in Fulfulde

The ordinals represent yet another interesting numerical paradigm and exhibit two types of ranking system that correspond to animate/inanimate distinction respectively. The first ordinal is not derived from the cardinal 1 (i.e. *go'o*). Clearly, a case of suppletion, since it is derivationally independent of 'one'. This suggests that Fulfulde is, yet, another language which can be categorized under languages in which 'first' (Atoyebi, 2005/2006). See, also, Stolz and Veselinova (2005:218). However, the rest of the ordinals are derived from the cardinals by the process of coordination, suffixation (e.g. ordinal 1 – 5), and vowel lengthening (cf. the contrast between animate and inanimate ordinals 21st to 29th: laso/lasoo) and whereas the final syllable in all the animate ordinals is an open one: *no* versus *bo*; the final syllable in its counterpart is closed: *nun* versus *bun.*, at least in the most basic ordinals 1st – 5th; in the rest of the ordinals the ordinal marker *jun* and *jo* are added at the end of the process to distinguish animate ordinals from the inanimate ones. Thus, in the derivation of ordinals 21st to 29th a combination of processes are involved that include coordination, vowel lengthening and syllabic change in the ordinal markers. Consider the following ordinals that instantiate these facts:

(6) Ordinals in Fulfulde

	<i>Animate</i>	<i>Inanimate</i>
1 st	arano	aranun
2 nd	dida bo	dida un
3 rd	tata bo	tata un
4 th	naya bo	naya un
5 th	joya bo	joya un
6 th	jee go'o jun	jee go'o jo

7 th	jee d'idi jun	jee d'idi jo
8 th	jee tati jun	jee tati jo
9 th	jee nayi jun	jee nayi jo
10 th	sappo jun	sappo jo
11 th	sappo i go'o jun	sappo i go'o jo
12 th	sappo i d'idi jun	sappo i d'idi jo
13 th	sappo i tati jun	sappo i tati jo
14 th	sappo i nayi jun	sappo i nayi jo
15 th	sappo i joyi jun	sappo i joyi jo
16 th	sappo i jee go'o jun	sappo i jee go'o jo
17 th	sappo i jee d'idi jun	sappo i jee d'idi jo
18 th	sappo i jee tati jun	sappo i jee tati jo
19 th	sappo i jee nayi jun	sappo i jee nayi jo
20 th	laso jun	lasoo jo
21 st	laso i go'o jun	lasoo i go'o jo
22 nd	laso i d'idi jun	lasoo i d'idi jo
23 rd	laso i tati jun	lasoo i tati jo
24 th	laso i nayi jun	lasoo i nayi jo
25 th	laso i joyi jun	lasoo i joyi jo
26 th	laso i jee go'o jun	lasoo i jee go'o jo
27 th	laso i jee d'idi jun	lasoo i jee d'idi jo
28 th	laso i jee tati jun	lasoo i jee tati jo
29 th	laso i jee nayi jun	lasoo i jee nayi jo

The main function of ordinal numerals in Fulfulde is to enumerate ranks within a particular hierarchy. Other functions include the possibility for an ordinal to be used as a noun phrase, as can be seen in the following constructions:

- (7) a. ned'do d'idifo on yaari suka on jangirde
 man second the took child the school
 "The second man took the child to school"
- b. pippid'do on wari maudu dun jee-didiwu
 hunter the killed lion the five + one
 "The hunter killed the seventh lion"
- c. wuro gon tatafo go Ali mahi iton ton yeeso
 house the third which Ali built is right ahead
 "The third house which built is right ahead"
- d. suka on arono i santi d'idifo on faamu
 boy the first is better than second the intelligent
 "The first boy is more intelligent than the second one"

Note from the foregoing chunk of data the fact that Fulfulde is a Head- First Language. However, ordinal counting is rare in Fulfulde speech communities, perhaps, this explains why it is not common for the speakers to go beyond 29th; even though, in principle, it is potentially possible to do so. This system of counting is mostly used to determine the position of a child in the hierarchy of children produced by a family (i.e. first child, second child, third child, etc.). It may also be employed to establish the succession of hereditary rulers in a particular dynasty: for example, first king, second king, third king, etc. But, infrequently used elsewhere.

An inspection of the above ranking patterns makes possible the following pertinent observations, in addition to the one earlier made. First and foremost, in this connection, we encounter three different linguistic scenarios: a paradigm characterized by a simpler pattern compared with the second and last sets. Essentially, as the ranking pattern successively increase from the first five ordinals to the ninth position, and from tenth to fifteenth, and so on so forth, each one of these ranking patterns shows an increasing complexity in their derivations. Secondly, the ranking that falls within the first five ordinals are realized as single lexical items that are distinguishable as either animate or inanimate via the suffixes *o* and *un* respectively which distinctively set it off from the rest of the ordinals. Thirdly, in the case of the other two major patterns, one can see that besides the use of the marker *jun* and *jo* to specify animate versus inanimate, respectively, there is a slight morphological change in the realization of 16th to 19th. For instance, we see the use of *jee* after the conjuncting particle *i* marks a complexity of a different order when compared with the mechanism that derives 11th to 15th, this owes to the fact that the numeral system is in the base five.

(4) Distributive Numerals in Fulfulde

Basically, these set of numerals are derived from cardinal numerals via either partial or complete reduplication. Another process exploited by these numerals is germination. In cardinals from 1 to 3 the reduplicative pattern entails the partial copying of the root and compounding and in some instances gemination; on the contrary cardinals 4 to 5 are derived by means of complete reduplication. These facts are evident in the examples below:

<i>Numeral Root</i>	<i>Derived Forms</i>
8)a. go'o - go'o 'one – one'	goggo'o 'one by one'
b. didi - didi 'two – two'	did'didi 'two by two'
c. tati - tati 'three – three'	tattati 'three by three'
d. nayi – nayi 'four – four'	nai-nayi 'four by four'

e. joyi – joyi ‘five – five’	joi-joyi ‘five- five’
f. jowe go’o- jowe go’o ‘five + one – five + one’	jeje – go’o ‘six by six’
g. jowe didi – jowe- didi ‘five + two – five + two’	jeje - didi ‘seven by seven’
h. jowe tati – jowe tati ‘five + three – five + three’	jeje – tati ‘eight by eight’
i. jowe nayi – jowe nayi ‘five + four – five + four’	jeje – nai ‘nine by nine’
j. sappooji – sappooji ‘ten - ten ‘	sappo – sapi ‘ten by ten’

There are a number of phonological operations at work here. There is vowel elision as instantiated in (8 a- c) above. We also observed a case of gemination in (8a - c: **-gg-**, **-dd-**, **-tt-**), even though, Fulfulde exhibits long consonants, yet what we have here is product of morphological operation that yields distributive system. Other processes include vowel shortening as in (8j). Both partial and complete reduplication are identifiable: (8a) through (8c) and (8j) exemplify the former, while examples (8d and 8e) demonstrate the latter.

The distributive numerals also occur within noun phrases irrespective of the positions they occupy in a sentence, where they function as quantifiers. Consider the following sentences:

- 9)a. sukaaɓe seendanaama mangoro goggo’o
children distributed mango one-one
‘Children have been given one mango each’
- b. sukaaɓe seendanaama mangoro diddidi
children distributed mango two-two
‘Children have been given two mangoes each’
- c. sukaaɓe seendanaama mangoro tattati
children distributed mango three-three
‘Children have been given three mangoes each’
- d. sukaaɓe seendanaama mangoro nai-nai
children distributed mango four-four
‘Children have given four mangoes each’
- e. sukaaɓe seendanaama mangoro joi-joi
children distributed mango five-five
‘Children have been given five mangoes each’

In all the sentences above, we have witnessed the occurrences of the distributive numerals sentence –finally, as quantifiers that modify the noun they co-occur with. However, it is noteworthy that these numerals can be fronted, thus forming a focused construction. This is obvious in the sentences below:

- 10)a. mangoro gogg'o non koo moi suka hokkaa
 mango one-one it is everyone of them child given to
 'One mango is given to every child'
- b. mangoro did'didi non koo moi suka hokkaa
 mango two-two it is everyone of them child given to
 'Two mangoes are given to each and every child'
- c. mangoro tattati non koo moi suka hokkaa.
 mango three-three it is everyone of them child given to
 'Three mangoes are given to each and every child'
- d. mangoro nai- nai non koo moi suka hokkaa.
 mango four-four it is everyone of them child given to
 'Four mangoes are given to each and every child'
- e. mangoro joi-joi non koo moi suka hokkaa
 mango five-five it is everyone of them child given to
 'Five mangoes are given to each and every child'

Having discussed the distributive numerals, the next phenomenon associated with numerals that merit consideration, here, is the notion of expressing 'times'. To this we now turn.

4. Multiplication Operation/Times in Fulfulde

The notion of multiples or times as in 'once', 'twice', 'thrice or three times' etc., is expressed by using the morpheme *de* signifying 'times' immediately followed by any numeral to generate the multiples as show-cased by the following:

- 11) de go'o
 'times one'
- de didi
 'times two'
- de tati
 'times three'
- de nai
 'times nine'
- de joi
 'times five'

5. Concluding Remarks

We have thus far explored and analyzed the structure of Fulfulde numerals. We identified some of the morphological and phonological processes evident in the various numerical formations. Processes such as reduplication, compounding, coordination, suppletion, vowel elision and vowel lengthening, as well as vowel shortening are some of the morphophonological operations that characterized the numerals and the process of numeration. There are, however, residual issues that await further research. This includes, among others, a detailed morphosyntactic description that captures the various distribution of these numerals in different constructions.

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Elements in Traditional and Modern Numerals of Nsukka Igbo

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This work studies the traditional and modern systems of numerals in Nsukka Igbo. The paper studies how cardinal numbers, fractions, decimals, days and money are expressed using numerals. Data for this study were collected using the interview method. Those native speakers who have not lived outside their hometowns for one week were used for the traditional form, while those who have had course to live outside their hometowns for a long time and those that have western education were used for the modern numerals. The major finding of this study is that some elements characterize the two forms of numeral. Such elements are the limit number, simple and complex distinction, arithmetic operands and idiosyncrasies. The traditional and modern forms use some of these elements in similar ways and some in differing ways.

Introduction

Numerals denote a class of specific group of words expressing quantity (Blazek 1999). They are definite words in a natural language that represent numbers (von Mengden 2010). Numerals are different from numbers and counting (see Wiese 2007). Numerals are the instantiation of numbers used to specify a set. The defining properties of numbers according to von Mengden (2010:64) are: first, they are properties of sets, and second, the set of (natural) numbers is a set of elements which form an ordered sequence. Numerals (systemic) possess the following qualities: they (1), constitute the numeral system of a language, (2) correspond to the counting words that occur in conventionalized counting sequence, (3) are used recursively as constituents of more complex (higher valued) numerals, and (4) are morphological basis for the formation of a corresponding form of any other type of numeral (i.e. ordinal, multiplicative, frequentive, etc.). Counting is also different from numerals. Counting seeks to find out the number of element in a finite set of objects. It is the action of finding out how many arrangements are there in a particular situation (Meng & Guan 2000:v). In assigning numbers, the elements of numeral system are used. Two kinds of number assignment exist: the cardinal and ordinal number assignments. Whereas the former determines the cardinality of a set “i.e. the size of a set measured by the number of its elements” the later “determines the position within an ordered sequence” (von Mengden 2010: 66).

According to Blazek (1999), numerals exist in all known languages (both the living and the dead). He goes further to note that “ it is possible that numerals are the same age as the idea of counting, hence, they could have to search no later than beginning the late Paleolithic” (Blazek 1999:iii). The study of numerals has followed the steps of description, structural analysis, and etymological analysis. The earliest compilation of numeral systems of many language families dates back to 1847 by Pott. The description of the numerals systems of all known languages in the 20th century are the works of Trombetti (1916) and Kluge (1937, 1938, 1939, 1941, and 1941-42). Trombetti (1916) contains enormous data which he used to study the

similarities existing in the numerals thereby proposing monogenesis of all languages. Kluge (1937-42), on the other hand, describes all the known numeral systems in his time but analysed only the structures that are clear to him. Kluge's data are argued to be "outdated and frequently inaccurate" but they presently give great insight into the study of numerals. Chan (1998-2011) is the most elaborate study of numerals of all known languages. The above studies are mainly on the description and structural analyses. An etymological analysis of numeral systems of selected languages using comparative-historical linguistic method is done by (Blazek 1999). A number of studies have been carried out on the analysis of numerals in many languages of the world. Some of them are Sahara (Petracek 1971), Nubian (Meinhof 1918-19); Sethe (1916) and Lopreino (1986); Berber (Woelfel 1954); Uralic (Honti 1993); Altaic (Ramstedt 1907, Kentowicz 1931, and Hamp 1970, 1974); and Indo European Languages (Sommer 1951, Szemerényi 1960, Winter 1986[90] Bammesberger 1986, Schmid 1989 and Gvodanovic (1992).

Some Benue-Congo languages where numerals have been studied include Yoruba (see Abraham 1958, Johnson 1921, Armstrong 1962, Oduyoye 1969, Oyebade 2010, Fábùnmi 2010), Ekiromi (Agoyi 2008), Nupe, Ebira, Esan, (Oyebade 2010), Igbo (Emenanjo 1978), and some others.

Nsukka Igbo refers to the variety of Igbo spoken in the northern part of Igboland (Ikekeonwu 1986 and Nwaozuzu 2008). The parts of the Northern Igbo used are mainly the towns within Nsukka senatorial zone.

This work is organized into four sections; the present section is the introductory aspect of the work. This is followed by the listing of the numeral systems found in counting of numbers, fractions, decimals, days, months, and money found in the Traditional Counting System (TCS) and in the Modern Counting System (MCS) respectively. The third section discusses some elements of the numeral systems identified in section 3. The last section summarizes and concludes the paper.

Numerals in Nsukka Igbo

Table 1: *Counting of numbers*

TCS	MCS	
m̀bụ náā	ótù	1
èbò	abụọ	2
ètọ	atọ	3
ènọ	anọ	4
ĩsé	ise	5
ĩshĩ	isii	6
èsáà	asaa	7
èsátọ	asatọ	8
ĩtégúná	iteghete/iteolu	9
ĩrí	ĩrí	10

ĩrí nẹ náā	iri na otu	11
ĩrí nẹ ẹbọ	iri na abụọ	12
ĩrí nẹ ẹtọ	iri na atọ	13
ĩrí nẹ ịsẹ	iri na ise	15
ĩrí nẹ ịshĩ	iri na isii	16
ĩrí nẹ ẹsaa	iri na asaa	17
ĩrí nẹ ẹsatọ	iri na asatọ	18
ĩrí nẹ iteguna	iri na iteghete/iteolu	19
ĩrí ẹbọ	iri abụọ	20
ĩrí ẹbo nẹ naa	iri abụọ na otu	21
iri ẹbọ nẹ ẹbọ	iri abụọ na abụọ	22
iri ẹbọ nẹ ẹtọ	iri abụọ na atọ	23
iri ẹbọ nẹ ẹnọ	iri abụọ na anọ	24
iri ẹbọ nẹ ise	iri abụọ na ise	25
iri ẹbọ nẹ ishii	iri abụọ na isii	26
iri ẹbọ nẹ ẹsaa	iri abụọ na asaa	27
iri ẹbọ nẹ ẹsatọ	iri abụọ na asatọ	28
iri ẹbọ nẹ iteguna	iri abụọ na iteghete	29
iri ẹtọ	iri atọ	30
iri ẹtọ nẹ naa	iri atọ na otu	31
iri ẹtọ nẹ ẹbọ	iri atọ na abụọ	32
iri ẹtọ nẹ ẹtọ	iri atọ na atọ	33
iri ẹtọ nẹ ẹnọ	iri atọ na anọ	34
iri ẹtọ nẹ ise	iri atọ na ise	35
iri ẹtọ nẹ ishii	iri atọ na isii	36
iri ẹtọ nẹ ẹsaa	iri atọ na asaa	37
iri ẹtọ nẹ ẹsatọ	iri atọ na asatọ	38
iri ẹtọ nẹ iteguna	iri atọ na iteghete	39
iri ẹnọ	iri anọ	40
iri ẹnọ nẹ naa	iri anọ na otu	41
iri ise	iri ise	50
iri ise nẹ naa	iri ise na otu	51
iri ishii	iri isii	60
iri ishii nẹ ẹbọ	iri isii na abụọ	62
iri ẹsaa	iri asaa	70

iri ɛsaa nẹ ẹtọ	iri asaa na atọ	73
iri ɛsatọ	iri asatọ	80
iri ɛsatọ nẹ ẹnọ	iri asatọ na anọ	84
iri iteguna	iri iteolu	90
iri iteguna nẹ ẹnọ	iri iteolu na anọ	94
inari	otu naari	100
inari nẹ naa	otu naari na otu	101
inari nẹ ẹbọ	otu naari na abụọ	102
inari nẹ iri	otu naari na iri	110
inari nẹ iri nẹ naa	otu naari na iri na otu	111
inari nẹ iri nẹ ẹbọ	otu naari na iri na abụọ	112
inari nẹ iri ẹbọ	otu naari na iri abụọ	120
inari nẹ iri ẹbọ nẹ ẹbọ	otu naari na iri abụọ na abụọ	122
inari nẹ iri ẹnọ	otu naari na iri anọ	140
inari nẹ iri ise	naari abụọ na iri ise	250
inari nẹ iri ise nẹ ishii	naari abụọ, iri ise na isii	256
inari ẹtọ	naari atọ	300
inari ẹtọ nẹ naa	naari atọ na otu	301
inari ẹnọ	naari anọ	400
inari ẹnọ nẹ iri nẹ naa	naari anọ na iri na otu	411
inari ise	naari ise	500
inari ise iri ise nẹ ishii	naari ise, iri ise na isii	556
inari ɛsaa	naari asaa	700
inari iteguna nẹ naa	naari iteolu na otu	901
kpuku	puku	1,000
adishi	nde	1,000,000
kuturuku	ijeri	1,000,000,000
yerere	-	1,000,000,000,000

Table 2: *Fractions*

S/N	TCS	MCS	Gloss
1	ẹkẹrẹ ẹbọ	ọkara	$\frac{1}{2}$
2	uzọ ẹbọ n'ẹkẹrẹ ẹtọ	uzọ abụọ n'uzọ atọ	$\frac{2}{3}$
3	uzọ ẹtọ n'ẹkẹrẹ ise	uzọ atọ n'uzọ ise	$\frac{3}{5}$
4	uzọ ẹbọ ẹkẹrẹ ẹsaa	uzọ abụọ n'uzọ asaa	$\frac{2}{7}$
5	ẹkẹrẹ ẹnọ	otu uzọ n'uzọ anọ	$\frac{1}{4}$
6	uzọ ise n'ẹkẹrẹ ishii	uzọ ise n'uzọ isii	$\frac{5}{6}$
7	uzọ iri n'ẹkẹrẹ iri ẹbọ nẹ naa	uzọ iri n'uzọ iri abụọ na otu	$\frac{10}{21}$
8	ẹkẹrẹ iri	otu uzọ n'uzọ iri	$\frac{1}{10}$
9	uzọ iteguna n'ẹkẹrẹ iri	uzọ iteolu n'uzọ iri	$\frac{9}{10}$

Table 3: *Decimals*

S/N	TCS	MCS	Gloss
1	ẹtọ nẹ ụma ise	atọ na ụma ise	3.5
2	ẹsatọ nẹ ụma ẹtọ	asatọ na ụma atọ	8.3
3	beru ihe ne iri nẹ naa/iri nẹ ụma (iteguna)	iri na ụma iteghete	10.9
4	beru ihe nẹ ẹtọ/ẹbọ nẹ ụma ẹsaa	abụọ na ụma asaa	2.7

Table 4. *Counting of Days*

S/n	TCS	MCS	Days (Gloss)
1	ta/nta	taa	today
2	echi/echiile	echi	tomorrow
3	ụnyaa	ụnyaa	yesterday
4	nwanne echi	nwanne echi	2 days to come
5	anọrọ ụnyaa	ụbọchị atọ na-abịa	3 days to come
6	izu kwe te	ụbọchị anọ na-abịa	4 days to come
7	echiile a si izu kwe te	ụbọchị ise na-abịa	5 days to come
8	nwanne echi a si izu kwe te	ụbọchị isii na-abịa	6 days to come
9	ẹbọ ụnyaa	ụbọchị asaa na-abịa	7 days to come
10	ẹbọ ta	ụbọchị asatọ na-abịa	8 days to come
11	ẹchiile a si ẹbọ	ụbọchị iteolu na-abịa	9 days to come

12	nwanne echi á sì ẹbọ	ụbọchị iri na-abịa	10 days to come
13	ẹtọ ụnyaa	ụbọchị iri na otu na- abịa	11 days to come
14	ẹtọ ta	ụbọchị iri na abụọ na- abịa	12 days to come
15	Echiile a sì ẹtọ	ụbọchị iri na atọ na- abịa	13 days to come
16	nwanne echi á sì ẹtọ	ụbọchị iri na anọ na- abịa	14 days to come
17	ẹnọ ụnyaa	ụbọchị iri na ise na- abịa	15 days to come
18	ẹnọ ta	ụbọchị iri na isii na- abịa	16 days to come
19	Ise ta	ụbọchị iri abụọ na- abịa	20 days to come
20	Ise ụnyaa	ụbọchị iri abụọ na otu na-abịa	21 days to come
21	ishii ta	ụbọchị iri abụọ na anọ na-abịa	24 days to come
22	ishii ụnyaa	ụbọchị iri abụọ na ise na-abịa	25 days to come
23	Ọnwa (ẹsaa ta)	ụbọchị iri abụọ na asatọ na-abịa	28 days to come
24	Mgba ahwa	otu afo	1 year
25	Akile	afo na-abịa	Next year
26	Ahwa ẹbọ biaja	afo abụọ na-abịa	2 years to come
27	ahwa ẹbọ nẹ okara biaja	afo abụọ na okara na- abịa	2½ years to come
28	Ashwanwa	nwanne ụnyaa	2 days ago
29	Echiile o kweru izu	ụbọchị atọ gara aga	3 days ago
30	izu kweru nta	ụbọchị anọ gara aga	4 days ago
31	izu kweru ụnyaa	ụbọchị ise gara aga	5 days ago
32	izu kweru ashwanwa	ụbọchị isii gara aga	6 days ago

33	Echiile o kweru ẹbọ	ụbọchị asaa gara aga	7 days ago
34	ẹbọ kweru nta	ụbọchị asatọ gara aga	8 days ago
35	ẹbọ kweru ụnyaa	ụbọchị iteolu gara aga	9 days ago
36	ẹbọ kweru ashwanwa	ụbọchị iri gara aga	10 days ago
37	Echiile o kweru ẹtọ	ụbọchị iri na otu gara aga	11 days ago
38	ẹtọ kweru ta	ụbọchị iri na abụọ gara aga	12 days ago
39	ẹnọ kweru ta	ụbọchị iri na isii gara aga	16 days ago
40	ise kweru ta	ụbọchị iri abụọ gara aga	20 days ago
41	ishii kweru ta	ụbọchị iri abụọ na anọ gara aga	24 days ago
42	ishii kweru ụnyaa	ụbọchị iri abụọ na ise gara aga	25 days ago
43	Esaa ta (onwa garu aga)	ụbọchị iri abụọ na isatọ gara aga	28 days ago

Table 5: Months of the Year

s/n	TCS	MCS/English Equivalent	Month (Gloss)
1	onwa mbu	onwa mbu/Jenuwari	1 st Month
2	onwa ẹbọ	onwa abụọ/ Febuwari	2 nd Month
3	onwa ẹtọ	onwa atọ/ Maachi	3 rd Month
4	onwa ẹnọ	onwa anọ/ Eprel	4 th Month
5	onwa ise	onwa ise/ May	5 th Month
6	onwa ishii	onwa isii/Juun	6 th Month
7	onwa ẹsaa	onwa asaa/ Julai	7 th Month
8	onwa ẹsatọ	onwa asatọ/Ogọost	8 th Month
9	onwa iteguna	onwa iteolu/Septemba	9 th Month
10	onwa mvu	onwa iri/Oktoba	10 th Month
11	–	onwa iri na otu/	11 th Month

		Novemba	
12	–	onwa iri na abuo/Disemba	12 th Month
13	onwa ndiishi/ ohwukehwu		
14	onwa aneseoba		

Table 6: Counting of Money

s/n	TCS	MCS	Money (Gloss)
1	anini	–	One quarter
2	afu	–	Half
3	Kopo	kobo	1kobo
4	Kopo ebọ	kobo abuo	2k
5	toro	kobo ato	3k
6	Kopo eno	kobo anọ	4k
7	Kopo ise	kobo ise	5k
8	Shishi	kobo isii	6k
9	Kopo esaa	kobo asaa	7k
10	Kopo esato	kobo asato	8k
11	nai	kobo iteolu	9k
12	Kopo iri ofu ego	kobo iri	10k
13	ego ebọ	kobo iri abuo	20k
14	ego eto	kobo iri ato	30k
15	ego eno	kobo iri anọ	40k
16	ego ise	kobo iri ise	50k
17	ego ishii	kobo iri isii	60k
18	ego esaa	kobo iri asaa	70k
19	ego esato	kobo iri asato	80k
20	ego iteguna	kobo iri iteolu	90k
21	ogu ego	naira abuo	N2
22	ogu ne iri	naira ato	N3
23	ogu ego ebọ	naira anọ	N4
24	ogu ego ebọ ne okara	naira ise	N5
25	ego iri	naira iri	N10
26	ogu (ego) iri	naira iri abuo	N20
27	ogu (ego) iri ne ise	naira iri ato	N30

28	ụlọ ego	naịra iri anọ	N40
29	ụlọ nẹ ise	naịra iri ise	N50
30	beru ise n'ụlọ ẹbọ	naịra iri asaa	N70
31	ụlọ ẹbọ	naịra iri asaa	N80
32	ụlọ ẹbọ nẹ ẹbọ nẹ ọkara	naịra iri asaa na ise	N85
33	ụlọ ẹbọ nẹ ise	naịra iri iteolu	N90
34	ụlọ ẹbọ nẹ ọkara	otu nari naịra	N100
35	ụlọ ẹsaa nẹ ise	otu nari naịra na iri ise	N150
36	akpa ego	nari naịra abụọ	N200
37	akpa (ego) nẹ ọgụ ego ise	nari naịra abụọ na iri	N210
38	akpa (ego) nẹ ụlọ ise	nari naịra abụọ na iri ise	N250
39	akpa (ego) nẹ ọkara	nari naịra atọ	N300
40	beru ụlọ nẹ iri nẹ akpa ẹbọ	nari naịra atọ na iri anọ	N340
41	beru ọgụ (ego) iri nẹ ise nẹ akpa ẹbọ	nari naịra atọ na iri asaa	N370
42	akpa (ego) ẹbọ	nari naịra anọ	N400
43	akpa (ego) ẹbọ nẹ ọkara	nari naịra ise	N500
44	akpa (ego) ẹtọ	nari naịra isii	N600
45	akpa (ego) ẹtọ nẹ ọkara	nari naịra asaa	N700
46	akpa (ego) ẹnọ	nari naịra asatọ	N800
47	akpa (ego) ẹnọ nẹ ọkara	nari naịra iteolu	N900
48	akpa (ego) ise	Otu puku naịra	N1000
49	akpa (ego) ẹsaa nẹ ọkara	Otu puku naịra nari ise	N1500
50	akpa (ego) iri	puku naịra abụọ	N2000
60	akpa (ego) iri ẹbọ nẹ ise	puku naịra ise	N5000

61	akpa (ego) iri ise	puku naịra iri	N10,000
62	akpa (ego) inarị	puku naịra iri abụọ	N20,000
63	akpa (ego) inarị nẹ iri ise	puku naịra iri atọ	N30,000
64	akpa (ego) inarị ẹbọ	puku naịra iri anọ	N40,000
65	akpa (ego) inarị ẹbọ nẹ ọkara	puku naịra iri ise	N50,000
66	akpa (ego) inarị ẹtọ	puku naịra iri isii	N60,000
67	akpa (ego) inarị ẹtọ nẹ ọkara	puku naịra iri asaa	N70,000
68	akpa (ego) inarị ẹnọ	puku naịra iri asatọ	N80,000
69	akpa (ego) inarị ẹnọ nẹ ọkara	puku naịra iri iteolu	N90,000
70	akpa (ego) inarị ise	Otu nari puku naịra	N100,000
71	akpa (ego) inarị iri	puku naịra nari abụọ	N200,000
72	akpa (ego) inarị iri ne ise	puku naịra nari atọ	N300,000
73	akpa (ego) inarị iri ẹbọ	puku naịra nari anọ	N400,000
74	akpa (ego) inarị iri ẹbọ nẹ ise	puku naịra nari ise	N500,000
75	akpa (ego) inarị iri ẹtọ	puku naịra nari isii	N600,000
76	akpa (ego) inarị iri ẹtọ nẹ ise	puku naịra nari asaa	N700,000
77	akpa (ego) inarị iri ẹnọ	puku naịra nari asatọ	N800,000
78	akpa (ego) inarị iri ẹnọ nẹ ise	puku naịra nari iteolu	N900,000

79	akpa (ego) inarịiri ise	Otu nde naira	N1,000,000
80	akpa (ego) kpukiri ise	Nde naira iri	N10,000,000
80	akpa (ego) adishi ise	Otu ijeri naira	N1b
81	akpa (ego) kuturuku ise	-	N1,000,000,000,000

Discussion

The elements and features that characterize the Nsukka numeral systems are discussed here in the dimension of the limit number, simple versus complex distinction, arithmetic operands and idiosyncratic numerals.

The limit number L

The cultural and scientific needs of a language determine the scope of its numeral system. The traditional form has all the cardinal numerical terms to meet its needs. Thus, it expresses 1,000,000,000,000 as *yerere* unlike what is obtainable in the modern form. Any number above *ijeri* is expressed as *agukata agba awaa* which literally means counting till the jaw breaks. In the traditional form uncountable numbers are expressed as *agumotegu*.

Simple versus Complex numeral expressions

Cross-linguistically, numerals are uniform in the sense that natural languages numerals comprise of simple and complex numeral expressions. Simple numerals are the easiest conceivable set of numerical expression in a language, which are monomorphemic forms with arbitrary phonological shape (see von Mengden 2008, 2010, and Dixon 2002). In the Nsukka dialect and in the Igbo language in general, the simple numerals are 1 - 10. In order to express the numerals that exceed 10 the language devices complex numerals. Complex numerals are the numbers that express morphosyntactic constituents of simple numerals (Detges 2003). Such complex numerals in the case study are from 11 that is (10+1) onwards. That is *iri na otu*. Thus the structure of complex numeral in Igbo is either the addition of two simple numbers (NUM → NUM + NUM) or a multiplication of two numbers (NUM → NUM x NUM).

The arrangement of complex numbers shows that simple numbers are subdivided into bases and atoms. Base is variously defined as a 'cyclic' pattern (Salzmann 1950:81), 'that number from which counting starts over' (Stampe 1978:270), 'a serialized multiplicand' (Greenberg 1978:270), and the 'smallest continuously recurring ordered subsequence' (von Mengden 2010:33). Atoms are "those morphologically simple elements of numeral systems that have the highest potential to form a continuously recurring (sub) sequence of numerals in combination with bases

or their multiples” (von Mengden 2010:39). In the study, *iri ebọ ne iteguna 29* is composed of base 10^2 and atom 9.

Arithmetic Operands

An operand is a quantity on which a mathematical or logical operation is performed. The types of arithmetic operations attested in the modern form of counting in Nsukka Igbo are multiplication and addition. Additionally, the modern form has subtraction and division. In multiplication, the numeral system of the Nsukka variety has multiplicands and multipliers. The multiplicands are the numbers that are to be multiplied by another. The multipliers are the sequences of multiplications. Thus, in relation to base and atom, multiplicands are like bases that are constant whereas multipliers are the variants which are like atoms. Thus, *inarị ebọ* for example, is 100×2 for 200 where the multiplicand is *inarị* and the multiplier is 2. In this case, the multiplier can go on till 9 after which another base *kpuku* (thousand) is reached. Unlike in the English language where the multiplicand is in the last position and its multiplier the first position like two hundred, in the Igbo language, apart from the cases where the multiplier is one. As in *otu naarị*, *otu puku*, *otu nde*, and *otu ijeri*.

For addition, like in multiplication, the addends are variables within a sequence of additions, while the augends are the respective constants. Therefore for the numerals that involve addition, (like *iri ne ise* ‘ $10 + 5$ ’, *iri ne esaa* ‘ $10 + 7$ ’, etc.) the atomic numerals (like 5 and 7 in the foregoing example) form the addends while the base numeral (10 or any of its multiples) becomes the augend.

Subtraction exists in the traditional counting of days. In *Echiile o kweru etọ* for instance, is $4 \times 3 - 1 = 11$ days ago. Thus the four days that make up one *izu* if multiplied by three becomes 12 days wherein one day is deducted so as to arrive at 11 days ago. The same thing is applicable to *Ebọ ònyàá 7* days to come which means $4 \times 2 - 1 = 7$ days to come. On the other hand, in counting money, subtractive operation can be used in the traditional system. An instance is *Bèrú ìsé n’ùlọ èbọ* becomes $N40 \times 2 - N2 \times 5 = N70$. Division is also obtainable in the traditional numeral system. This can be seen in the counting of days as in *Ìsé tà* which was got from $20 \div 4$ (20 divided by 4) = 5 *izu*.

Idiosyncratic Numerals

Idiosyncrasy in this context refers to “the deviation of a particular element or of a particular sequence of elements in so far as their respective form or formation deviates from what we would expect by analogy with equivalent sequences or with neighbouring elements in the counting sequence” (von Mengden 2010:52). He further identifies the following two categories of idiosyncrasies in numeral systems:

1. Some forms of the numeral system can deviate from the formation pattern of the neighbouring forms in the counting sequence.

- a. They are simple (arbitrary and mono-morphemic) forms at a place in the sequence of numerals where a complex form would be expected, or
 - b. their morphological structure deviates merely on formal grounds from what the analogy with the main part of the numeral system would predict, or
 - c. their morphological structure deviates because the formation is based on an arithmetic operation different from what the analogy with the main part of the numeral system would predict.
2. The phonological shape of a particular simple numeral can vary if used as a constituent in a more complex numeral.
 - a. They are allomorphic variants of their corresponding simple expressions, or
 - b. they are functional variants encoding the type of arithmetic operation underlying the combination.

In the Nsukka TCS, idiosyncrasies manifest in fractions, counting of days, and money. The predominant linguistic feature that one observes in them is elision. Elision is the process of removing a phoneme or more in an utterance. In fractions, $\frac{1}{2}$ $\acute{u}z\grave{o}$ is deleted in any one-part of a fraction. For counting of days, $\acute{iz}\grave{u} kw\grave{e} t\acute{e}$, the full form is $\acute{iz}\grave{u} \grave{e}b\grave{o} kw\grave{e}r\grave{u} t\acute{a}$. Also in the counting of money, it is only in one base that $\acute{e}g\bar{o}$ is mentioned especially in higher denominations like $\acute{u}l\grave{o} \acute{e}g\bar{o}$ (N40), once it exceeds one, ego may be deleted as in $\acute{u}l\grave{o} \grave{e}b\grave{o}$ N40 x 2, $\grave{a}kp\grave{a} \grave{i}s\acute{e}$ N200 x 2.

There are also tonal deviations evident in both the TCS and MCS. Generally, in the Igbo language tone plays two major functions: lexical and grammatical. Some inherent tones may change in the course of grammatical constructions. Such tonal changes are observed in the construction of complex numerals in the Nsukka variety of Igbo. A few of such instances are:

7.
 - a. $\grave{e}b\grave{o}$ ‘2’
 $t\acute{a}$ ‘today’
 $\grave{e}b\acute{o} t\grave{a}$ ‘8 days to come’
 - b. $\acute{E}g\bar{o}$ ‘money’
 $\acute{I}r\acute{i}$ ‘10’
 $\acute{E}g\acute{o} \acute{I}r\bar{i}$ ‘N10’
 - c. $\acute{I}r\acute{i}$ ‘10’
 $\grave{A}n\acute{o}$ ‘4’
 $\acute{I}r\acute{i} \grave{a}n\bar{o}$ ‘40’

d. kpúkú	‘1000’
Ìsé	‘5’
kpúkú Ìsē	‘5,000’

In 7 above, the tone of the first words in c and d remain unchanged while in a and b, the two words have their inherent tones changed.

Summary and Conclusion

This study has examined the numeral patterns that we have in Nsukka variety of Igbo. Two patterns exist. They are the traditional and modern counting patterns; the modern numeral system is made up of the forms mainly spoken in the Standard Igbo whereas the traditional forms represent the ones typical of the native speakers of Nsukka dialect. The kinds of numerals considered include ordinary numbers, fractions, decimals, counting of days, months, and money. The data reveal that there are some features that characterize Nsukka numeral systems. The numbers in the traditional system is enough for its cultural and scientific expression. In the two forms, there are simple and complex numbers. The complex numbers are arranged in such a way that the bases are clearly marked from atoms. The arithmetic operands existing in them are addition and multiplication. Additionally, the traditional form contains subtraction and division. The idiosyncratic elements observed in the two numerical systems are elision and tonal deviations. In conclusion, generally, the Igbo language (and in particular Nsukka Igbo) numerals are rich in expressing numerals for its cultural and scientific needs without any course for borrowing from another language.

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The Miship Traditional Numeral System

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This paper discusses Miship traditional numeral. The Miship language belongs to the West-Chadic sub-group of the Afro-Asiatic phylum spoken by 17,000 people in Plateau State, Nigeria. The study covers the following areas of numeration, such as cardinals, ordinals, numerals adverbs, distributive numerals, fractional numerals and other expressions of quantity in the language.

1. Miship cardinal numerals

A cardinal numeral is a numeral of the class whose members are considered basic in form, used in counting and used in expressing how many objects are referred to.

Examples:

Cardinal numeral

1	kəme
2	vəl
3	kun
4	feer
5	baat
6	pemee
7	pokvəl
8	pokkun
9	pokfaar
10	sár
11	sár po kəme
12	sár po vəl
13	sár po kun
14	sár po feer
15	sàr po baat
16	sár po pemee
17	sár po pokvəl
18	sár po pokkun
19	sár pok faar
20	ya gurum
21	ya gurum kə kəme
22	ya gurum kə vəl
23	ya gurum kə kun
24	ya gurum kə feer
25	ya gurum kə baat
26	ya gurum kə pemee
27	ya gurum kə pokvəl
28	ya gurum kə pokkun

29	ya gurum kə faar
30	ya gurum kə sár
31	ya gurum kə sar po kəme
32	ya gurum kə sár po vəl
33	ya gurum kə sár po kun
34	ya gurum kə sár po feer
35	ya gurum kə sár po baat
36	ya gurum kə sár po pemee
37	ya gurum kə sár po pokvəl
38	ya gurum kə sár po pokkun
39	ya gurum kə sár po faar
40	yák gurum vəl
50	yák gurum vəl kə sár
60	yák gurum pemee
70	yák gurum kun kəsár
80	yák gurum feer
90	yák gurum feer kəsár
100	ǵali kəmə
101	ǵali kəmə kə kəme
108	ǵali kəme kə pokkun
110	ǵali kəme kə sár
115	ǵali kəme kə sár po paat
120	ǵali kəme kə ya gurum
130	ǵali kəme kə ya gurum kə sár
180	ǵali kəme kə yák gurum feer
188	ǵali kəme kə yák gurum feer kə pokkun
190	ǵali kəme kə yák gurum feer kə sár
199	ǵali kəme kə yák gurum feer kə sár po pok faar
200	ǵali vəl
300	ǵali kun
400	ǵali feer
500	ǵali paat
600	ǵali pemee
700	ǵali pokvəl
800	ǵali pokkun
900	ǵali pokfaar
1000	ǵali sár
1001	ǵali sár kə kəme
1400	ǵali sár po feer
1445	ǵali sár po feer kə yák gurum vəl kə paat
1756	ǵali sár po pokvəl kə yák gurum vəl kə sár po pemme

1800	ḍali sár po pokkun
1999	ḍali sár po pokfaar kə yák gurum feer kə sár po pokfaar
2000	ḍali ya gurum
2001	ḍali ya gurum kə kəme
2011	ḍali ya gurum kə sár po kəme
2111	ḍali ya gurum kə kəme kə sár po kəme
2770	ḍali ya gurum kə pokvəl kə yák gurum kun kə sár
2888	ḍali ya gurum kə pokkun kə yák gurum feer kə pokkun
4000	ḍali yák gurum vəl
5000	ḍali yák gurum vél kə sár

From the foregoing examples, we observe that to form

- a. numerals from 11 - 19, the process involves selecting *sár*, i.e. the word for “ten”, followed by *po* which translates as ‘plus’ and then the appropriate value from 1 - 9.
- b. numerals from 21 – 30, the process involves selecting *ya gurum*, i.e. the word for “twenty”, followed by *kə* which translates as ‘plus’ and then the appropriate value from 1 – 10.
- c. numerals from 31 – 39, the process involves selecting *ya gurum kə sár*, which is the value for 30 (i.e. 20 + 10) followed by *po* which translates as ‘plus’ and then the appropriate value from 1 – 9 (e.g. 31 = 20 + 10 + 1 (*ya gurum kə sár po kəme*)).
- d. numerals from 40 – 90, the processes for derivation are more complex.
- e. numerals from 100 – 1,000,000 use *ḍali* “hundred” as the base.

One interesting fact about the counting system of Miship is that all the cardinal numbers with the exception of *sár* “ten” and first syllable of the word for forty (*yák*) have high tone, all other cardinal numbers have mid tone.

Miship ordinal numerals

The ordinal numerals, just like the adjectives, function attributively in sentences. They agree in gender and number with the noun they qualify. An ordinal in Miship is derived from the corresponding cardinal numeral through the processes prefixation. With the exception of first (1st) which uses different stem from the cardinal numeral, all other ordinals in Miship are derived by prefixing the morpheme *-wu* to the corresponding cardinal number, as in:

Ordinal numerals

wu nshe	1 st (first)
wu vəl	2 nd (second)
wu kun	3 rd (third)
wu feer	4 th (fourth)

wu paat	5 th (fifth)
wu pemee	6 th (sixth)
wu pok vəl	7 th (seventh)
wu pokkum	8 th (eighth)
wu pok faar	9 th (ninth)
wu sár	10 th (tenth)
wu sár po kəme	11 th (eleventh)
wu sár po vəl	12 th (twelfth)
wu ya gurum	20 th (twentieth)
wu ya gurum kə sár	30 th (thirtieth)
wu yák gurum vəl	40 th (fortieth)
wu yák gurum vəl kə sár	50 th (fiftieth)
wu yák gurum kun	60 th (sixtieth)
wu yák gurum kun kə sár	70 th (seventieth)
wu yák gurum feer	80 th (eightieth)
wu yák gurum feer kə sár	90 th (ninetieth)
wu ɗali	100 th (one hundredth)
wu ɗali sár	1,000 th (one thousandth)

From the foregoing, we observe that the prefix *-wu* is added in the initial part of the number from 2nd (second) up to 12th (twelfth). But in order to form 20th to millionth, the rule changes because *ya gurum*, *yák gurum* and *ɗali* are infixed between *-wu* and the cardinal units in question, depending on the formation of the ordinal numerals. Similarly, there seems to be no tonal differences between the cardinal and the ordinal numerals.

Miship numeral adverbs

English numeral adverbs are “once”, “twice”, etc. In Miship, numeral adverbs are formed through the process of prefixation. The morpheme *yit-* is added or prefixed to the cardinal numerals, as shown below:

Numerals adverbs

yit kəme	once
yit vəl	twice
yit kun	thrice/three times
yit feer	four times.
yit paat	five times
yit pernee	six times.
yit pokvəl	seven times
yit pokkun	eight times.
yit pok faar	nine times
yit sár	ten times

Similarly, there is also another morpheme *-so* which is used to form the numeral

adverbs in the language; it is found more in the speech of the younger generation. The morpheme *so-* is believed to have been borrowed from Hausa. It follows the same pattern in numeral adverb formation as the morpheme *-yit*.

Examples:

Numerals adverbs

so kəme	once
so vəl	twice
sò kun	thrice/three times
sò feer	four times
sò paat	five times
sò pemee	six times
sò pokvəl	seven times
sò pokkun	eight times.
sò pok faar	nine times
sò sár	ten times

From the foregoing, it is clear that *yit-* and *sò-* can be said to be in free variation because they can be used interchangeably without affecting the meaning. The only issue observed is that *yit-* is commonly used by the older people, while *-sò* is used by the younger people.

Miship distributive numerals

Distributive numerals are special adnominal numerals that express distributive relation. In Mishap, these types of numerals are formed through a process of reduplication. The cardinal numerals or numbers undergo the process of complete/total reduplication, as in:

Numerals adverbs (Complete/total reduplication)

kəme-kəme	one each
vəl-vəl	two each
kun-kun	three each
feer-feer	four each
paat-paat	five each
pemee-pemee	six each
pokvəl-pokvəl	seven each
pokun-pokun	eight each
pokfaar-pokfaar	nine each
sár-sár	ten each
sár po kəme-sár po kəme	eleven each
sár po vəl -sár po vəl	twelve each
sár po kun- sár po kun	thirteen each
sár po feer- sár po feer	fourteen each
sàr po baat- sàr po baat	fifteen each

sár po pemee-sár po pemee	sixteen each
sár po pokvəl-sár po pokvəl	seventeen each
sár po pokkun-sár po pokkun	eighteen each
sár pok faar- sár pok faar	nineteen each
yagurum- yagurum	twenty each
yagurum kə kəme -yagurum kə kəme	twenty one each
yagurum kə vəl -yagurum kə vəl	twenty two each
yagurum kə kun -yagurum kə kun	twenty three each
yagurum kə feer -yagurum kə feer	twenty four each
yagurum kə baat- yagurum kə baat	twenty five each
ɗali kəmə-ɗali kəmə	one hundred each
ɗali sár-ɗali sár	one thousand each

The above examples show that Miship distributive numerals can only be formed through the process of complete reduplication. In some other Chadic languages (e.g. Margi and Kilba), however, distributive numerals can be derived through two or more other methods (cf. Hoffman (1963); Dlibugunaya (1988) and Mu'azu (1995, 2003, 2009, 2010)).

Miship fraction

A fraction is derived from the Latin word *fractus*, meaning broken. A fraction is a number that can represent part of a whole. The earlier fractions were reciprocal of integers, symbols representing *half*, *one-third*, *on-quarter* and so on. A much later development were the common fractions which are still used today, and which consist of a numerator and a denominator, the numerator representing a number of equal part and a denominator telling how many of these parts make up a whole.

A fraction can be expressed in Miship by: *lək*, *dəbot* and *kənar* all meaning *half*. There are other fractions in the language which are expressed via the ordinal numerals, for instance, *wu feer* “fourth”, *wu paat* “fifth” and *wu pemee* “sixth” and so on. In Miship, the morpheme that carries the fractional meaning is suffixed to the appropriate noun.

Examples:

moor lək
oil half
‘half bottle of oil’

sherep lək
fish half
‘half fish’

dəbot le
half cloth
‘half cloth’

dəbot buhu shuu
 half bag guinea corn
 ‘half bag of guinea corn’

mu ko se fe kənar kət-kət
 they shared food the middle equally-equally
 ‘They shared the food into two equal parts’.

a ɓak kənar yar kət
 I divide middle road equal
 ‘I divided the road into two halves’.

shuu fe gam ma ni kənaar
 guinea corn the full not half
 ‘The guinea corn is not full but half’.

Other expressions of quantity in Miship

There are other words in Miship which are classified as expressing indicating some kind of quantity. It is important to note that they are not a grammatical category in the language, but they play a very prominent role in describing certain things/situations. Among these are: **wuyon** “the majority” or “great number” and **duk-duk** “everything”.

wuyon kə jep fe awat mu
 majority of children the thieves are
 ‘The majority/most of the children are thieves’.

wuyon kə ngurummuseet lə
 most of people bought houses
 “The majority/most of the people bought houses”.

wuyon kə shorop mu ji
 majority of women they came
 “The majority/most of the women came”.

wuyon kə das fe mu wak
 most of men the they left
 ‘The majority/most of the men left’.

wuyon kə ngurum mu muut
 majority of people they die
 “The majority/most of the people die”.

shorop fe duk-duk
 women the all
 “all the women”

das fe duk-duk
men the all
“all the men”

nyen gəlong fe duk-duk
of people trades the all
“all the traders”

duk-duk kə mu
all of them
“all of them”

duk-duk fuk
all you
“all of you”

ngum fe mu duk-duk
car the they all
“all the cars”

lə fe mu duk-duk
house the they all
“all the houses”

The above examples revealed that the Miship word (wuyon) “majority /most/ great deal of” as well as (duk-duk) “everything / all” referring to means “all” in English, can occur alone after or before a noun. In forming a Miship phrase or sentence.

Finally, it is pertinent now to points out that majority of Miship numerals have a mid tones with the exception of few which have high and low tone patterns. All words/ numerals that their tones are not mark in this paper have mid tones.

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The Numeral Systems of Nkpor and Gboko: A Comparative Analysis

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Most numeral systems of indigenous languages and their dialects have been rapidly replaced by those of dominant languages or standard forms and more so, by the English language. The surviving ones use a variety of numeral systems which are invaluable linguistic data that should be documented. This paper records, documents and analyses the numerical systems of Nkpor and Gboko dialects of the Igbo and Tiv respectively. Igbo and Tiv belong to the Benue-Congo language family. The result of the finding reveals that the two dialects have cardinal and ordinal numbers. But while the Nkpor simple cardinal numerals are all single words, Gboko dialect has numerals 7 and 9 as complex numerals. Again, the Gboko dialect has singular and plural morphemes for some of the simple cardinal numerals. The paper therefore, recommends that effort should be made to record and document numeral systems of Nigerian languages and their dialects in order to preserve their rich linguistic as well as cultural heritage.

Introduction

Numerals, according to Mengden (2010), are the linguistic representatives of number. Number refers to a word which represents an amount. Numbers are indicated in the singular or plural forms and they are usually nouns. According to Levi (2001), numbers usually incorporate numerals and may, therefore, be seen as a kind of device that we need in specifying the numerical system of languages. Comrie (2004) defines the numeral as a symbol or mark used to represent a number or a symbol or group of symbols used to express a number. Levi (2001) states that the term 'numeral' can refer to:

- a. numeral system, a system of mathematical notation for writing numbers.
- b. number names, the words used in a language or writing system to represent numbers.

A numerical system, according to Ifrah (1999), therefore, is a writing system for expressing number that is a mathematical notation for representing numbers of a given set, using graphemes or symbols in a consistent manner. Following Hurford (2002), the distinction between numeral and number is that while numerals are the expressions that are used for referring to numerically specific quantifiers, number is the set of non-referential expressions that is used in the conventionalised counting sequence. Again, Wiese (2003) says that numbers are infinite, but the numeral system of a natural language has a highest expressible number which is determined by the cultural and scientific needs of a language community.

The Nkpor Dialect

Nkpor is a speech community, according to Okeke (2006), located at about six kilometres East of Onitsha, with Ogidi to the North, Obosi to the South-East and

Umuoji to the East. The town is at the South-western part of Idemili North Local Government Area of Anambra State of Nigeria. Linguistically, the Nkpor dialect is one of the Niger Igbo dialect clusters of the Igbo language (See Ikekeonwu's (1986) classification of Igbo dialects). But a more recent classification, according to Nwaozuzu's (2008), places Nkpor dialect under south eastern Igbo dialect cluster. Grammatically, early forms of the dialect had much in common with the Igbo language, but the present Nkpor dialect appears, after centuries of geographical proximity to have absorbed some grammatical influences from neighbouring dialects like Ogidi, Onitsha, and Obosi.

The Gboko Dialect

Gboko is a speech community in Benue State and also one of the towns in the Tiv kingdom. According to Wombo (1997), Tiv is one of the minority ethnic groups that occupy part of the region popularly referred to as the Middle Belt of Nigeria. Genealogically, Tiv is made up of Ipusu (uncircumcised) and Icong (circumcised). Gboko falls under Ipusu (the uncircumcised group). Popular views, according to Wombo (1997), regard Gboko speech norms as the seat of the Tiv tradition authority as the central, standard and authentic representation. Gboko dialect is prominent in Gboko, Vandeikya, Buruku, Usongo, part of Kwande, Tarka and Konshisha Local Government Areas. There is also a Southern Gboko variation of Tiv prominent in such Local Government Areas like Gwen, Gwer-West, Makurdi and Guma. The Gboko dialect is chosen for this work because it represents the political centre of the Tiv language, culture and people.

Numerals in Nkpor

Numerals in Nkpor, just as in standard Igbo, are referred to as *onyi ogugu*, where *onyi* means – mouth and *ogugu* means – counting. Nkpor has a vigesimal or base numeral system based on twenty. Nkpor numerical system is of two types – cardinal and ordinal numbers. The smallest unit of counting in Nkpor is zero *efu*, while the highest unit of counting is 400 *nnu*. Higher numbers like 1000, 1200, etc., can be achieved by adding to four hundred (400) (*nnu*) using the base twenty, (the details are discussed later).

Cardinal Numerals in Nkpor

When someone counts items, one uses cardinal values. In grammatical terms, a cardinal number is a word used to represent a countable quantity. Cardinal numbers constitute one way by which plurality in nouns is expressed (see Wiese (2003) and Jadranka (1999)). They function as pronominal modifiers. In Nkpor dialect, as in many other languages, such as English, French, Yoruba, etc., according to Beresiri (2001), cardinal numbers are generally construed as nouns, but function as adjectives. When functioning as adjectives, in English, according to Beresiri (2001), cardinal numbers may only precede countable nouns, and the noun will be plural, except for one (1) or minus one (-1). Examples, according to Beresiri (2001), are:

-
1. Zero dogs
 One cat
 One hundred one Dalmatians
 minus one degree
 minus five meters,

But in Igbo and languages where their determiner systems are postposed (i.e., Igbo noun phrase (NP), is head-initial)), the phenomenon is not applicable.

(a) *Simple Cardinal Numerals*

The simple cardinal numerals are used in deriving other numerals and include the numbers: 0, 1 – 10 as listed below.

2. zero	efu
one	ofu/mbu/naa
two	ibua
three	itọ
four	ino
five	itse
six	itsii
seven	itsaa
eight	itsato
nine	itenaani
ten	ili

(see Appendix I for a more comprehensive list)

In English and most languages, numbers come before nouns but in Nkpor and the Igbo language in general, numbers come after the noun they modify.

Examples:

3. Ewu atọ three goats
 Oche itse five chairs

It is only ofu (1), oru (20), nnu (400), etc., that can come before the noun. It is true we have cardinal and ordinal numerals, but the distinction is not there. It is only clear in ofu, oru and nnu.

Examples:

Cardinals

- 4a. ofu mmadu 'one person' *mmadu ofu
 oru mmadu, 'twenty persons' * mmadu oru
 nnu mmadu 'four hundred person' *mmadu nnu

-
- | | | |
|----|---|--|
| g. | Nnụ na itsato
four hundred and eight | $400 + 8 = 408$ (four hundred and eight) |
|----|---|--|

ii *Multiplication Method*

This is achieved by multiplying a simple cardinal numeral by *oru* ‘twenty’ for the numerals 40, 60, 80, 100, 200, 300, 800, 1200, etc.

- | | | |
|-----|-----------------|--|
| 6a. | Ogụ naabọ | $20 \times 2 = 40$ (forty) |
| b. | Ogụ itọ | $20 \times 3 = 60$ (sixty) |
| c. | Ogụ inọ | $20 \times 4 = 80$ (eighty) |
| d. | Ogụ ili | $20 \times 10 = 200$ (two hundred) |
| e. | Ogụ ili na itse | $20 \times 15 = 300$ (three hundred) |
| f. | Nnụ naabọ | $400 \times 2 = 800$ (eight hundred) |
| g. | Nnụ itọ | $400 \times 3 = 1200$ (one thousand two hundred) |

It is worthy of note to state here that (6e) is a typical example of a numeral functioning as a noun modifier. *Ogụ* (20) modifies *ili na itse* thus, 15 into 20 places = 300 (*ogụ na itse*). But in (5f), *ogụ* (20) is not a noun modifier and as such only the addition method applies. In (6e), *ogụ ili na itse* equals $20 \times 10 + 5 = 205$. This explains the reason why (*mkpụlụ*) – pieces are used by some Nkpor dialect speakers to differentiate between 300 and 205, since the expression is ambiguous. The above explains the ambiguous nature of *ogụ ili na itse*, which Emenanjo (1978) also observes. The numerals 500, 600, 700, 900, 1000 are derived by adding 100, 200, and 300 respectively to 400, as in:

- | | | | |
|-----|--|---------------|---------------------|
| 7a. | Nnụ na ogụ itse
four hundred and one hundred | $400 + 100 =$ | 500 (five hundred) |
| b. | Nnụ na ogụ ili
four hundred and two hundred | $400 + 200 =$ | 600 (six hundred) |
| c. | Nnụ na ogụ ili na itse
four hundred and three hundred | $400 + 300 =$ | 700 (seven hundred) |
| d. | Nnụ naabọ na ogụ itse
eight hundred and one hundred | $800 + 100 =$ | 900 (nine hundred) |
| e. | Nnụ naabọ na ogụ ili
eight hundred and two hundred | $800 + 200 =$ | 1000 (one thousand) |

 ii *Multiplication and Addition Method*

The subtraction method is not present in Nkpor cardinal numeral system rather the method of multiplication and addition of ten could be employed in deriving numerals like 50, 70, 90, 190, etc.

- | | | |
|---|----------------------|------------------------------|
| 8a. Oḡu naabọ na ili
twenty x two and ten | $20 \times 2 + 10 =$ | 50 (fifty) |
| b. Oḡu itọ na ili
twenty x three and ten | $20 \times 3 + 10 =$ | 70 (seventy) |
| c. Oḡu inọ na ili
twenty x four and ten | $20 \times 4 + 10 =$ | 90 (ninety) |
| d. Oḡu itenaani na ili
twenty x nine and ten | $20 \times 9 + 10 =$ | 190 (one hundred and ninety) |

Suffice it to note that subtraction can be applied in Nkpor only in the process of counting money, where '*belu*' (meaning less) is used.

Example:

9. Belu ọkala akpa ego n'akpa ego ise, which is equal to ₦900.00

Where *Ọkala akpa ego* means ₦100.00 and (*Ofu*) *akpa ego* means ₦200.00, so *akpa ego ise* = ₦200 x 5 = ₦1000.00 minus ₦100.00.

Therefore, example (9) means less (*belu*) ₦100 from ₦1,000.00 = ₦900.00.

It is only in a situation like (9) that the subtraction method could be used in counting in Nkpor. But the subtraction method of numeral system abounds in many other languages. For instance, according to Obikudo (2006: 3) subtraction could be achieved by the use of *fa* which means less (derived from *faa* meaning loss) in Iḡani, a threatened Eastern Ijoid dialect spoken in Bonny and Opobo L.G.A of Rivers State. According to Obikudo, numerals such as 16 – 19, 26 – 29, 36 – 39, 46 – 49, 56 – 59, etc are derived in this way.

- | | |
|--|----------------|
| 10a. iḡni ḡ fa si ḡ
four less twenty | 'sixteen' |
| b. teḡreḡ fa soḡ
three less thirty | 'twenty seven' |
| c. mmeḡeḡ fa mme si ḡ
two less two twenty | 'thirty eight' |

Also, a look at the Roman numerals in writing shows an instance of subtraction, as in:

- 11a. iv, where 'i' = one and v = five, i.e. $5(v) - 1(i) = 4(iv)$
 b. ix, where 'i' = one and x = ten, i.e. $10(x) - 1(i) = 9(ix)$, etc.

Ordinal Numerals in Nkpor

Ordinal numerals according to Jadranka (1999) refer to a position in a series. As we have earlier mentioned, in Igbo, it is true according Oluikpe (1981) that we have cardinal and ordinal numerals but the distinction is not there. It is only clear in 'otu'. Example: *otu* and *mbu* (one and first):

- 12a. mmadu mbu 'first person' (ordinal) and not
 b. *mmadu otu (rather it is
 c. otu mmadu 'one person' (cardinal)).

The above situation in standard Igbo is also applicable in Nkpor dialect of Igbo. In Nkpor, *nke* is used to specify the position of an entity being referred to by the ordinal numeral.

- 13a. ewu (nke) mbu 'first goat'
 b. ewu nke abuo 'second goat'
 c. ewu nke ato 'third goat'
 d. ewu nke ano 'fourth goat'

Onye (person) and *ndi* (group) are used to make individual or group reference in terms of the entity being referred to by the ordinal number:

- (14) a. onye nke mbu 'the 1st person'
 b. Ndi nke mbu 'the 1st person group'
 c. onye nke ibua 'the 2nd person '
 d. Ndi nke ibua 'the 2nd person group'
 e. onye nke ili 'the 10th person'
 f. Ndi nke ili 'the 10th group'

Unlike in English where higher ordinals, according to Ifrah (1999), are no often written in words unless they are round numbers (thousandth, millionth, billionth), Nkpor and Igbo in general write ordinal numbers just as they write cardinal numerals with the introduction of *nke*.

15. Onye nke puku ili ito na ino 'the 30,004th person'

A few Nkpor numerals have special names (in addition to their regular names: 0 = *efu* has several other names, depending on the context.

Zero equals *efu* = in counting

	<i>nkịti</i>	=	nothing (used technically to refer to an object or idea related to nothingness)
One can be	<i>ofu/mbu, izizi</i>	as in	
	<i>ofu</i>	=	unit
	<i>mbu</i>	=	first
	<i>izizi</i>	=	first
Two can be	<i>ibya/ibonibo</i>		
	<i>ibya</i>	=	two
	<i>ibonibo</i>	=	pairs

The Gboko Numeral System

The numerical system in Gboko is known as Ingyer. Gboko also has the cardinal and ordinal numbers. The smallest unit of counting in Gboko is zero (Oo) while the highest unit of counting is 1000 (Dudu).

Cardinal Numeral in Gboko (see Appendix II for the Cardinal Numbers)

As we said earlier, numbers are generally construed as nouns but function as adjectives. This is also applicable to the Gboko dialect. But one striking feature of Gboko numeral system is that it has both singular and plural prefixes in the form of **u-** for singular numerals and **a-** for plural numerals, as in:

- 16a **u**har two (singular)
ahar two (plural)
- b. **u**tar three (singular)
atar three (plural)
- c. **u**nyiin four (singular)
anyiin four (plural)

a. Simple Cardinal Numerals

In many African languages, such as Igbo, Yoruba, Hausa, Edo, Idoma, the first ten cardinal numerals are simple; they are made up of individual words. The situation in Gboko is different. Let us observe the Gboko cardinal numerals 1 – 10.

- | | |
|---|------------------|
| 1 | mo#m |
| 2 | u har |
| 3 | u tar |
| 4 | u nyiin |
| 5 | u taan |
| 6 | a teratar |
| 7 | u taan kar u har |
| 8 | a nien |

9	utaan kar unyiin
10	pue

Adapted from Chan (2010)

A look at cardinal numerals 7 and 9 in Gboko shows that they are derived by the addition of two (*uhar*) and four (*utaan*) to five respectively. Thus, we have

Utaan kar uhar
Five more than two, i.e. $5 + 2 = 7$

Utaan kar unyiin
Five more than four, i.e. $5 + 4 = 9$

Chan (2010), in his explication of the numeral systems of the world languages, also observes this phenomenon and says that “Tiv has a vigesimal system with special constructions of numbers 7 and 9.” This phenomenon notwithstanding, simple cardinal numerals are used in deriving other numerals. They include 0, 1 – 10, 15, 20, 30, 40, 50 60, 70, 80, 90, 100, 1000, as listed below:

18a. 0	Zero	Oo
1	One	mo#m
2	Two	uhar
3	Three	utar
4	Four	unyiin
5	Five	utaan
6	Six	ateratar
7	Seven	utaan kar uhar
8	Eight	anieni
9	Nine	utaan kar unyiin
10	Ten	pue
15	Fifteen	pue kar utaan
20	Twenty	kyundu
30	Thirty	kyundugber
40	Forty	Akundu ahar
50	Fifty	Akundu ahargber
60	Sixty	Akunduatar
70	Seventy	Akundu atargber
80	Eighty	Akundu anyiin
90	Ninety	Akundu anyiingber
100	(One) hundred	Deri (mo#m)
1000	(One) thousand	Dubu (mo#m)

Hundred and one	$100 + 1 = 101$
b. Deri utaan kar uhar Hundred five more than two	$500 + 200 = 700$
ii <i>Multiplication Method</i> This is achieved by multiplying the plural form of a simple cardinal numeral by twenty (<i>akundu</i>) which is the plural form of the unit 20 (<i>kyundu</i>), as in 40, 60, 80, 200, 300, 400, 500, 600, 800, etc.	
22a Akundu ahar Twenty two (plural) Two twenties	$20 \times 2 = 40$ 'forty'
b. Akundu atar Twenty three (plural) Three twenties	$20 \times 3 = 60$ 'sixty'
c. Deri ateratar Hundred six Six hundreds	$100 \times 6 = 600$ 'six hundred'

iii *Multiplication and Addition Method*

Just like in the Nkpor dialect of Igbo, the subtraction method is not applied in Gboko, rather the method of multiplication using *akundu* (twenty in plural form) and the simple cardinal numerals, plus ten could be adopted to derive 50, 70, 90, etc.

23a Akundu ahar gber Twenty two (plural) ten	$20 \times 2 + 10 = 50$ 'fifty'
b. Akundu atar gber Twenty three (plural) ten	$20 \times 3 + 10 = 70$ 'seventy'
c. Akundu ahar gber Twenty two (plural) ten	$20 \times 2 + 10 = 90$ 'ninety'

Ordinal Numerals in Gboko

Ordinal numerals in Gboko, just like in Nkpor, makes a distinction between *ofu* – one and *mbu* – first. In Gboko, the morphological forms of *mo#n* – one and first (*hiihii*) differ. See examples 24 and 25.

24a. Ivo i–hiihii	first goat
b. Ivo i–sha uhar	second goat
c. Ivo i–sha utar	third goat

-
- d. Ivo i-sha unyiin fourth goat

In example 24a – d, *ivo* stands for goat, *i* is a singular marker, *sha* – a demonstrative (pointer), while *hihihi*, *uhar*, *utar*, *unyiin* are first, second, third and fourth respectively.

To specify the position of the entity being referred to by the ordinal numeral in Gboko, *or* person and *u* – singular/plural marker, are used depending on the subject of the construction, as in:

- 24a. Or u-sha hihihi first goat
 b. Or u-sha uhar second goat
 c. Or u-sha utar third goat
 d. Or u-sha unyiin fourth goat

So, apart from the first ordinal numeral, all other ordinal numbers are derived through a combination of *or* (person), *u*- (singular/plural marker), *sha* (demonstrator) and the normal simple cardinal numbers. Like the cardinals, ordinals also function as pronominal modifiers in Gboko dialect.

Differences and Similarities between Nkpor and Tiv Numeral Systems

A close look at the Nkpor and Gboko numeral systems reveal some striking similarities and differences, which are as follows:

- a. Both have a vigesimal or base numeral systems based on twenty. By this we mean that larger units are derived by multiplying the base twenty (20) with the simple cardinal numbers (see e.g. 6a-h and 22a-c and 23a-c).
- b. Both have the cardinal (simple and complex) and ordinal numbers. But while Nkpor simple cardinal numbers are single words (see example 2), numbers 7 and 9 in Gboko simple cardinal are complex (see 17). Again, Gboko simple cardinals have the prefixes *u*- (for singular) and *a*- (for plural).
- c. In the two numeral systems, the smallest unit of counting is zero. But while the highest unit of counting is 400 in Nkpor, since larger units like 500, 600, 800, 1000, etc., can be achieved by adding to 400, the highest unit counting is 1000 because larger units are derived by adding to 1000 (*dubu*), usually twenty (*akundu*).
- d. Nkpor cardinals like 1 (*ofu*), 20 (*oru*) and *nnu* (400) can only be preposed before the nouns as in:

- 25a. ofu mmadu not *mmadu ofu - 1 person
 b. oru mmadu not *mmadu oru - 20 persons
 c. nnu mmadu not *mmadu nnu - 400 persons

Other cardinals like 10 (*ili*), *oru na ili* (30), *ogu naabo* (40), *ogu ise* (100), etc., can be postposed or preposed in respect of the position of the on the noun, as in:

26a.	ili mmadu or mmadu ili	10 persons
b.	oru na ili mmadu or mmadu oru na ili	30 persons
c.	ogu ise mmadu or mmadu ugu ise	100 persons etc

In Gboko, all their numbers are post-posed after the noun, as in:

- 27a. Ivo mom
- b. Ivo uhar
- c. Ivo utar, etc.

- e. In the two numeral systems, 20 when it is not referring to the unit twenty, has a different name to show plural. In Nkpor, *oru* (20) in plural form is *ogu*, while in the Gboko dialect of Tiv, *Kyundu* (20) is the singular form and *akundu* is the plural form. This phenomenon is also applicable to ten in Gboko *pue*, while the plural ten is known as *-gber*, a suffix attached to the main numeral.
- f. Both make use of the addition, multiplication and addition methods for deriving larger units. The subtraction method of deriving larger units does not apply to the cardinal numeral of the two speech forms, as we have it in the written form of the Roman numerals and the Ibani dialect of Bonny and Opobo spoken in Rivers State. The subtraction method is, however, applicable in money counting in Nkpor (see example 8).
- g. In Nkpor and Gboko, ordinal numerals abound. While Nkpor uses *nke* to particularise the entity being referred to by the ordinal numeral and *onye* to show position, the structure of ordinal numerals in Gboko is more complex. They have morphemes *I* and *sha* indicating singular marker and a demonstrator, respectively. For position, Gboko employs *or*, which the equivalent of *onye*, *u*–singular/plural marker and *sha* – a demonstrator.

5. Summary of the Findings and Conclusion

The paper has investigated the numeral systems of Nkpor and Gboko dialects of the Igbo and Tiv languages respectively. It is observed that the two dialects have both cardinal and ordinal numerals. But while the Nkpor the first ten cardinal numerals are all simple words (see example 2), Gboko has numerals 7 and 9 as complex numerals (see example 17). From the analysis also, Nkpor has a different term (*ogu*) for twenty in the plural form which serves as the base for deriving larger units. This situation is achievable in Gboko with twenty (*kyundu*), which is known as *akundu* in plural form upon which larger units are formed, but also with the ten (*pue*) whose plural form is *gber*. *Gber* usually serves as a suffix to the main number for deriving larger units, (see example 22 and 23). Another significant discovery of this paper is that Gboko has singular and plural morphemes ‘*u-*’ and ‘*a-*’ respectively which are attached to the simple cardinal numbers, (see example 19 above) to form plural used in forming larger units. This situation does not applicable in Nkpor; in short, Nkpor has no morpheme for singular or plural in their cardinal numeral system. Singular and plural

forms are only possible in their ordinal system, where *onye* is the singular form and *ndi* is the collective form.

This paper also discovered that Gboko numeral system is vigesimal in nature which is in line with Chan's (2010) observation in his study of the Tiv language. Nkpor dialect also enjoys this feature vigesimalization, which is absent in standard Igbo.

From the discussion also, it is plausible to categorise cardinal numerals a subclass of quantifiers. That is, cardinal numerals in the two dialects are part of a large class of expressions which all specify or limit the reference of a set or an entity. The expression quantified (usually a noun) then denotes the kind of elements that are contained in this set. The Quantifier, according to Mendgen (2010), shares a number of semantic and functional as well as formal properties. There is a range of semantic nuances exhibited by quantifiers – and in particular cardinal numerals – in interaction with the quantified noun. While cardinal numerals assignment specifies the cardinality (the number of elements of a set), ordinal numerals assign a place within a fixed order to a particular elements of a set. Again in the two dialects ordinals are always the morphologically marked forms, that is, they are always morphological derivatives of cardinals.

The Nigerian polity is home to many different peoples, each with its own peculiar way of exposing thoughts and ideas. These features set them apart from others and contribute to the cultural treasure of the country. Different languages in Nigeria use a variety of different numeral systems, likewise different dialects that make up these languages. It therefore, becomes pertinent to preserve these invaluable linguistic data by documenting them as soon as possible because the indigenous numerical systems of many dialects and even minority ethnic groups are particularly prone to be replaced by neighbouring politically and economically predominant languages. The younger generations, according to Chan (2010), tend to give up the traditional numeral systems and adopt the borrowed one. This is prevalent in Gboko that borrowed *pue* (ten) and *deri* (hundred) from the Hausa language.

It is also observed from our study that dialectal indigenous numeral systems are even more endangered than other linguistic systems even if the language is not itself endangered. The reason is because during rapid globalization, the act of counting in the dialect and minority languages is left to older members of the community, while the younger generations often tend to shy away from native numerals and prefer to express numerals in English or the standard variety of the language. The result is that the traditional numeral systems of most dialects of our major languages are being replaced rapidly by those of their standard forms and English. This paper has therefore, taken a step in documenting the numeral systems of two dialects of two languages in Nigeria using a comparative approach with a view to record and preserve the traditional counting systems before they fizzle out. Linguistic scholars both in Nigeria and abroad should therefore, make it a point of duty to record, document and analyse the numeral systems of Nigerian languages and their dialects in order to preserve their rich linguistic heritage before they are completely buried.

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Appendix I

1	ofu/nnaa
2	iḅua
3	iṭo
4	iṇo
5	itse
6	itsii
7	itsaa
8	itsaṭo
9	itenaaṇi
10	Ili
11	Ili na ofu
20	Oru
21	Oru na ofu
30	Oru na ili
31	Oru na ili na ofu
40	Og̣u naaḅo
41	Og̣u naaḅo na ofu
50	Og̣u naaḅo na ili
51	Og̣u naaḅo na ili na ofu
60	Og̣u iṭo
61	Og̣u iṭo na ofu
70	Og̣u iṭo na ili
71	Og̣u iṭo na ili na ofu
80	Og̣u iṇo
81	Og̣u iṇo na ofu
90	Og̣u iṇo na ili
91	Og̣u iṇo na ili na ofu
99	Og̣u iṇo na ili na itenaani
100	Og̣u ise
101	Og̣u ise na ofu
190	Og̣u itenaani na ili
199	Og̣u ise na og̣u iṇo na ili na itenaani
200	Og̣u ili
205	Og̣u ili na (mkp̣uḷu) ise
300	Og̣u ili na ise
400	Nṇu
500	Nṇu na og̣u ise
600	Nṇu na og̣u ili
700	Nṇu na og̣u ili na ise
800	Nṇu naaḅo
900	Nṇu naaḅo na og̣u ise
1000	Nṇu naaḅo na og̣u ili
1200	Nṇu iṭo

Appendix II

1	mo#m
2	uhar
3	utar
4	unyiin
5	utaan
6	ateratar
7	utaan kar uhar
8	anieni
9	utaan kar unyiin
10	pue
11	pue kar mo#m
20	kyundu
21	kyundu kar mo#m
30	kyundugber
31	kyundugber kar mo#m
40	Akundu ahar
41	Akundu ahar kar mo#m
50	Akundu ahargber
51	Akundu ahargber kar mo#m
60	Akunduatar
61	Akunduatar kar mo#m
70	Akunduatargber
71	Akunduatargber kar mo#m
80	Akunduanyiin
81	Akunduanyiin kar mo#m
90	Akunduanyiingber
91	Akunduanyiingber kar mo#m
99	Akunduanyiingber kar utaan kar unyiin
100	Deri (mo#m)
101	Deri man mo#m
110	Deri man pue
199	Deri man Akunduanyiingber kar utaan kar unyiin
200	Deri uhar
300	Deri utar
400	Deri unyiin
500	Deri utaan
600	Deri ateratar
700	Deri utaan kar uhar
800	Deri anieni
900	Deri akunduanyiingber
1000	Dubu mo#m
1200	Dubu mo#m man deri uhar
9000	Dubu utaan ka unyiin, etc.

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The System of Numeration in Edo

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Numerals are indices employed for counting in Edo, a main language spoken in Edo State of Nigeria. Numerals occur specifically under the quantifier group of the determiner category in the language. Edo operates a numeral system which employs (a) addition (b) subtraction, and (c) multiplication principles in its representation. A computational analysis of the different categories of numerals in the language reveals that Edo numerals may be morphologically simple or complex. The simple numeral constituents comprise indices whose morphological structures are simple and easy to derive and comprehend. The internal structure of the complex numeral constituents comprises lexical units and grammatical units with categorial and semantic features that complement one another to represent a single numeral. Some of the higher numerals have clausal constructions in their underlying representations. Our analysis of the numerals reveals that they represent the Edo native speaker's ways of interpreting the different quantities specified by them.

1. Introduction

This paper presents a study on the system of numeration in Edo. It investigates the varying derivational processes available in the language for expressing the system. The paper also examines the agreement patterns within the different structural forms of the numerals. The paper explores the morphological and semantic properties of elements of the numerals that had not been previously considered in the interpretation of enumeration in the Edo language.

Edo is the language of the Ancient Benin Kingdom, spoken as a main language in the Benin metropolis and its environs in the highly heterogeneous Edo state. Edo belongs to the Kwa sub-group of the Niger-Congo phylum (Greenberg, 1963) and the North Central Edoïd (NCE) branch of the genetically related languages and dialects of the Edoïd group of languages (Elugbe, 1986).

Contrary to the assumption that numerals have single structures, the internal structure of most numerals in Edo reveal a complex form whose combinations are made possible by lexical and grammatical units with categorial and semantic features that complement themselves in the realization of the S-structure single numerals.

The study shows that the internal structures of the numerals represent the Edo native speakers' interpretation of them. The merging of the different units is made possible by their idiosyncratic features which are checked for coherence with the final semantic and phonetic structures of the numerals. If the features match, they converge and are considered to be grammatical. If the features do not match, they 'crash'; in which case, their structure is ill-formed.

1.2 Previous Works

Many of the previous studies on the system of numeration in Edo (Amayo 1976, Imasuen 1997, Omoregie 1986, 2009), only identify in passing the majority of numerals in the language and their order of occurrence (i.e. from the lowest to the

highest numbers). They also claim that most numbers are formed either by the addition or subtraction methods. None of the works focuses on the internal computations of the numerals to ascertain the units that make them up and the agreement features exhibited by them.

1.3 Present Study

By employing the computational system of analysis by which lexical computation is handled in natural language, we combine relevant units to form larger structures identified as (complex numerals). The Edo lexicon comprises the relevant units (i.e. resources from which items that are minimally split to make meaningful syntactic and semantic structures are drawn and computed). These items are computed in the Working Area by the application of the three operations: Select, Merge and Move. A number of economy principles combine to act on the derivations to achieve interpretable structures. For example, to derive the numeral – *evayanugie* (22), the grammar picks or selects from the lexical resources, the base form, **ugie** (20), the additive items **eva** (2) and the **yan** (more than) and then merges them in the appropriate order of occurrence. See the derivation below:

1. Base form	Additive items	Numerals
ùgié '20'	èvá 'two' yán 'more than/exceed'	èváyánùgìé '22'

The combination of such morphological forms as numerals involves the simultaneous addition of all the features that are important in computing a derivative. All these operations take place within the working Area. At a point in the computation of these items, the derivation splits at the point of Spell-out into the two components: A.P and C.I levels. At Spell-out, any movement which will affect the derivation thereby causing ill-formedness is determined if the units above are not properly merged, the numerals will be ill-formed as in ***yan eva ugie** or ***ugie eva yan**. These derivations crash because the order of occurrence of the units is altered. To ensure well-formedness of the numerals, the features of the items combining are checked.

2. The Concept of Numeration in Edo

The concept of numeration in Edo is based upon the idea that numbers are used to quantify items of different sorts. In this case, number is taken as a word or a quantity. Numeral quantifiers are thus indices which are used for counting in Edo. The indices are mainly used to qualify nominals and as such cannot be divorced from other nominal determiners in Edo.

Edo employs a numeral system which uses addition, subtraction and multiplication principles in its representation. Two kinds of numerals: (1) Cardinal and (2) Ordinal are attested in Edo.

2.1 Cardinal Numerals

Cardinal numerals comprise all numbers in the different counting categories. The units employed in this class of numerals construction are listed below:

-
- 2a) ìgbé 'ten'
- b. ùgié 'twenty'
- c. ùrí arria 'two hundred'
- d. ébò 'two hundred thousand'
- e. ùyè 'two hundred million'

'Ìgbé' as a unit is the basic number that occurs in all numbers from eleven. The 'ìgbé' system of counting involves numbers 1 – 14 and all the numbers in this category are morphologically simple and cannot be further divided into constituent parts. The numbers are represented in the data below:

3.	Number	Gloss	Number	Gloss
	òwó/ókpá	'one'	èrènrèn	'eight'
	èvá	'two'	ìhìnrín	'nine'
	èhá	'three'	ìgbé	'ten'
	èné	'four'	òwọ́rọ́	'eleven'
	ìsẹ̀n	'five'	ìwèèvà	'twelve'
	èéhàn	'six'	iweeha	'thirteen'
	ìhìnrón	'seven'	ìwèèhè	'fourteen'

The formation of the numerals in data 3 above involves a one-to-one correspondence representation. This group also constitutes the simple numerals whose internal structure is made up of only the numbers they represent.

The units: 'ùgié/ìyí', ekigbese, uri/arria, ébò, ùyè and ikiokhọe are used to derive numerals whose internal computations involve complex structures. These complex numerals comprise both numbers and grammatical units which combine to give higher numbers which appear simple in their derived form. The numbers specified by these units began from fifteen to other higher numbers in their different categories. The data below show the derivation of some of these numbers.

4.	Underlying Form	Derived Form
a)	èkésè ùgié count five before twenty	èkésugié 'fifteen'
b)	ìyí-èvá twenty into two	iyévà 'forty'
c)	ìsẹ̀n-yán-urí five exceed 200	ìsẹ̀nyánurí 'two hundred and five'
d)	arri-èhá 200 into three places	àrriàéhá 'six hundred'
e)	ébò-èvá 200,000 into two	ébòévà 'four hundred thousand'

f)	ùyè-òkpá	uỳeòkpá	‘two-hundred million’
	200,000,000 in one place		

The data in example 4 shows the derivation of different categories of complex numbers in Edo using the units listed in 2(b-e). 4(a) represents higher numbers derived by the unit ‘ùgié’ and other sub-units like ‘èkésè’. Other categories of numbers in this group which will be fully examined in section 4 reveal more complex structures. The numbers accommodated by the **ùgié** unit are 15-29.

4b reveals another structural form of numbers which are derived using the unit, ‘ìyì’. **Iyi** is a plural variant of ‘ùgié’ which is used to indicate multiples of 20 to derive higher numbers. The numbers accommodated by ‘ìyí’ include all multiples of 20 from 40 to 180 (i.e. 40, 60, 80, etc.).

4c shows the derivation of yet another number which involves the use of the unit, ‘ùrí’. **Uri** encodes two hundred (200) in the same way that ‘ùgié’ encodes twenty (20) or ‘igbe’ (10) or **ògbàn** (30). **Ùrí** has a bound variant, ‘àrriá’ which may be used instead of ‘ùrí’ as in **ùrí évá; àrriá évá**; both of which derive the number, 400. The use of **ùrí** however terminates at two thousand (i.e. **ùrí vbírié ìgbé** – 200 into 10 places) for speakers who find it easier to use **ùrí** than **aria** from the number, one thousand (**àrriá ìsén**). Otherwise, **ùrí** terminates at one thousand while **aria** is used to derive higher numbers (as in **àrriáísén** ‘one thousand’).

The unit ‘ébò’ in 4(e) encodes two hundred thousand (200,000). This number can be re-expressed as **ùrí vbíhè àrriásèn** ‘two hundred in one thousand places’. **Ébò** in two places (**ébò évá**) derives the higher number ‘four hundred thousand’, as in 4(e) and other such numbers expressing thousands and only millions.

Úyè in 4 (f) expresses the numbers, two hundred million. One thousand **ébò** (**ébò àrriáísén**) is found, in one **ùyè**. **Úyè** expresses higher millions, billions, trillions and others.

The units **ébò** and **ùyè** were used in the old Edo society to express large numbers or quantities of items which had monetary and other values when cowries and pounds were used as currencies. In ordinary usage, **ébò** means an old sack woven with palm tree leaves to carry bags of money. **Úyè** means ‘ditch’ or wide hole dug specifically for gathering money. Thus, **ébò íghó** (**ébíghó**) and **ùyè íghó** (**ùyíghó**) mean ‘plenty of money in their respective quantities’. In section 3, we examine the three basic principles employed in the formation of numerals in Edo.

Ordinal numbers constitute another kind of numerals in Edo. These numerals occur less frequently than their cardinal counterparts. The ordinal numbers specify positions in series. They are used before a specific figure to show the position of something in a series. The numerals are derived by prefixing the bound morpheme, **ógìe** or its definite surface form, **nógìe** to a cardinal number. The examples below show the derivation of such ordinal numbers.

5.	<i>Underlying Form</i>	<i>Derived Form</i>	
a)	òkàrò/né òkàrò first/the first	òkàrò/nókàrò	‘first/the first’
b)	ógìè-èvá/nógìè èvá position two/the position two	ógìevà/nógìevà	‘second/the second’
c)	ógìè ìgbé/nógìè ìgbé Position ten/ the position ten	ógìgbè/nógìgbè	‘tenth/the tenth’

5a-c show the D-Structure and S-Structure representations of ordinal numbers in both their emphatic and non-emphatic usages. The particle **ùkpógìè** may also be prefixed to cardinal numbers to derive more emphatic and specific references as in **ùkpógìéhà – nùkpógìéhà** ‘thirdly’. Other ordinal numbers in Edo include **nókìekìè** ‘the last/lastly’, **nòzélélèè** ‘next/the next’, **dèbààrè** ‘additionally/in addition’, **òvbéhè** ‘another’ and others.

3. Operational Principles in Edo Numeral System

The three basic principles that the Edo numeral system employs in the representation of numbers are (i) addition, (ii) subtraction and (iii) multiplication. These principles are used to reflect increase of items whose quantities need to be specified. Each of the principles represents a systematic manner of reflecting such increase of items as we show in the sections that follow.

3.1 The Addition Principle

The addition principle is fully operational when a lower number is added onto a higher number with the use of operative verbs which have the feature [+add]. The examples in the data below show how the addition mechanism operates.

6.	<i>Underlying Form</i>	<i>Derived Form</i>	
a)	òkpá yàán ùgìé one exceed twenty	òkpányánùgìé	‘twenty-one’
b)	ìsén yàán ùgìé five exceed twenty	ìsényánùgìé	‘twenty-five’
c)	ènè yàán ógbàn four exceed thirty	ènéyánógbàn	‘thirty-four’
d)	ìhínròn yàán ìyévà seven exceeds forty	ìhínrònyánìyévà	‘forty-seven’

In example 6a-d, increase of numeral items is shown by the addition of a lower single number (e.g. **òkpá** ‘one’) to a higher number (e.g. **ìyévà** ‘40’). Both numbers are joined

together by the addition particle **yàán**. Operation Select, selects these units in their order of occurrence and merge them. The derivation ‘crashes’ if the order of occurrence of the units combining is violated. This means that the derived higher number is ill-formed and unacceptable in Edo.

Another manner of reflecting increase using the addition principle is the method employed in (Imasuen 1992:49) which involves the two operational words **vbè** and **yàán**. This is a rather complex method which involves starting with the highest number in the series. This is followed by the first additive unit, **vbè** ‘and’ and then the other items in their order of occurrence. The examples below illustrate how this addition mechanism works.

7.	<i>Underlying Form</i>	<i>Derived Form</i>
a)	ìyísèṇ èṇé vbè ókpá-yàán ìyéhà one hundred four and one exceed sixty	ìyísèṇèṇévbèókpáyànyéhà ‘461’
b)	àrriá èhá vbè èkígèṣìyèṇé 200 three and seventy	àrriáhávbèkígèṣìyèṇé ‘670’
c)	ìyísèṇ èṇé vbè èrèṇrèṇ-yàán-èkígèṣìyèṇé one hundred four and eight exceed seventy-eight	ìyísèṇèṇévbèèrèṇrèṇ ‘478’

The examples in 7a-c reveal that the addition principle can be employed for deriving different categories of higher numbers. The principle in 7a-c is used to derive numbers from one hundred and above while addition mechanism in 6a-d derives numbers less than one hundred.

Note that in 7a-c, the conjunction ‘vbè’ is carefully selected to join together the numbers that are merging to form the highest number in the series. Such merging is not required in 6a-d.

3.2 The Subtraction Principles

The subtraction principle specifies systematic mechanism for reflecting increase in number like the addition principle in 3.1. The subtractive principle is made possible by employing the units: (i) **èkésè** (ii) the present tense negative marker ‘I’, (iii) the preposition ‘vbè’ (which is homophonous with the co-ordinating conjunction ‘vbè’ in 7a-c) and other items. The examples below show the internal structure of the numerals derived by the subtractive principle.

8.	<i>Underlying Form</i>	<i>Derived Form</i>
a)	èkésè ùgié five-less twenty	èkésúgié ‘15’
b)	èṇé í rrò vbè ìyísèṇ four out of 100	èṇéírròvbìyísèṇ ‘96’
c)	èvá í rrò vbè ìyísèṇ èhá remove two from 300	èváírròvbìyísèṇèhá ‘298’

d)	ìyísẹ̀n í rrọ̀ vbẹ̀ ẹ̀bò 100 away from 200,000	ìyísẹ̀n í rrọ̀ vbẹ̀ ẹ̀bò	‘190,000’
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The data in 8a-d reveals that the subtractive principle accommodates both lower and higher numbers in reflecting increase. The four operative or subtractive units which make this mechanism possible are carefully selected and put in strategic positions before the last number. In 8a, the unit ‘èkésè’ is a surface bound morpheme which is literally expressed as ‘five-less than a particular number’ usually twenty and other higher numbers. It thus denotes an instruction to remove five from the number that follows it. 8b-d reveals the internal structure of numbers which begins with a lower number followed by the units **í**, **rrọ̀** and **vbẹ̀** before the last number. The formation of these numbers is guided by the Edo native speakers’ knowledge of the mathematical operation of subtraction generally. It is a reduction principle which lowers existing numbers to get the desired new number. The omission of any of the operative units (i.e. **í**, **rrọ̀** and **vbẹ̀**), or the violation of the order of occurrence of the items cause the derived number to ‘crash’, as shown in the data below:

9.	<i>Underlying Form</i>	<i>Derived Form</i>
a)	*ìyísẹ̀n í rrọ̀ vbẹ̀ ọ̀gbàn 100 out of 30	ìyísẹ̀n í rrọ̀ vbẹ̀ ọ̀gbàn ?
b)	*èvá vbẹ̀ í rrọ̀ ọ̀gbàn two in out of 30	èvá vbẹ̀ rrọ̀ ọ̀gbàn ?

Well-formedness of numbers using the subtractive mechanism is ensured by the language by exposing the speakers to the general subtractive principles.

3.3 The Multiplication Strategy

Numbers involving multiplication in Edo occurs in different categories, as shown by the data below:

10.	<i>Underlying Form</i>	<i>Derived Form</i>
a)	ìyí èvá 20 multiplied by 2	ìyévà ‘forty’
(b)	ìyí isẹ̀n 20 multiplied by two	ìyísẹ̀n ‘one hundred’
(c)	ùrí èvá 200 multiplied by two	ùriéva ‘four hundred’
(d)	àrriá èhá 200 multiplied by three	àrriáhà ‘six hundred’

The data in 10a-d show the formation of higher numbers by employing the operative units: ìyí, ùrí and àrriá each of which has been characterized in section 2.1. Each of these units encodes ‘multiple of...’ and occurs before the number they are multiplying. The subtraction of the items (as in *èvá ìyí) will cause the derived number to crash. The strategy here can also be considered as addition if one interprets ìyí èvá for example to mean 20 plus 20 or 20 in two parts.

The data below illustrate another set of numbers derived by the multiplication strategy.

11. Underlying Form	Derived Form	
(a) ùgié vbè íhè èvá 20 in two places	ùgié vbíhèvá	‘forty’
(b) ùrí vbè íhè èhá 200 in place three	ùrí vbíhèhá	‘six hundred’
(c) àrriá ìsén vbè íhè àrriásén 200 five in place 200 five ‘1000 in 1000 places’	àrriásén vbíhè àrriásén	‘one million’
(d) ébò ìsén vbè íhè àrriá ìsén 200,000 five in place 200 five ‘1,000,000 in 1,000 places’	ébìsén vbíhè àrriásén	‘one billion’

The operative item in 11a-d is represented as vbè-íhè whose surface form is vbíhè (in places). This item occurs between the multiplier and multiplied. Each of the examples in 11a-d may be interpreted as x multiplied by y where x is the multiplied item and y is the multiplier.

The next set of data show yet another structure of numbers derived by the multiplicative mechanism.

12. Underlying Form	Derived Form	
(a) òkpá yàán ìyí èvá One exceed 22 (i.e. 20 multiplied by two plus one)	òkpányán ìyèvá	‘forty-one’
(b) ìsén í rrò vbè ìyí ìsén Five not be in 25 (i.e. five away from 20 multiplied by five)	ìsénírrò vbìyísén	‘nine-five’
(c) ìyí évá yàán àrriá ìsén 22 exceed 200 five (i.e. 20 multiplied by 2 plus 200 multiplied by five)	ìyèvá yánàrriásén	‘1,040’

-
- | | | | |
|-----|--|-------------------------|-------|
| (d) | ìyí èvǎ yàán ùrí
20 two exceed 200
(i.e. 20 multiplied by 2 plus 200) | ìyevǎ yánùrí | ‘240’ |
| (e) | ìgbé yàán ìyí ìsén vbè íhè èvǎ
10 exceed 20 five in place two
(i.e. 10 plus 100 multiplied by 2) | igbéyàán úyìsén vbíhèvǎ | ‘220’ |

The data 12a-e shows the derivation of higher numbers whose computations involve the combination of the multiplication strategy with either the addition or subtraction strategies. To ensure well-formedness of the numbers in this category the features of the different units in combination must be considered. Note that any of the principles can be applied first or last at the middle of the derivation depending on the number being formed. In the data above, the multiplication principle is applied more frequently than the other two because of the numbers involved.

3. Summary and Conclusion

We have examined in this paper the system of numeration in Edo. We have shown that Edo employs the three basic counting principles of addition, subtraction and multiplication to attain a smooth flow of number formation. The counting system does not have single words for most numbers in the language. The language represents such numbers by applying any of the principles or a combination of them as revealed by the different sets of data presented in the preceding sections.

Each of the items in the derivations is carefully selected and merged to ensure well-formedness. The knowledge of the formations is based mainly on the Edo speakers' mathematical knowledge of the different principles generally. Each of the principles may be used to specify quantities of a variety of items apart from the basic exercise of counting.

Apart from the basic numerals 1-14, and a few others, all numbers from 15 have complex internal structure whose derivations may 'crash' if the features of the combining items are not properly checked. Both the cardinal and ordinal numerals in the language as in other languages, can be used to modify nouns like other normal modifiers in the language. We conclude that the Edo numeral system is a rather complex one as revealed by their computations.

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The Bura Numeral System

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The paper discusses the numeral system of Bura – an endangered language spoken in the southern part of the present-day Borno State, Nigeria. The language belongs to the Chadic branch of the Afro-Asiatic family. The other major members of the family include Semitic, Egyptian, Cushitic, Omotic and Berber. The paper examines Bura numerals, classifying them into four different types namely: cardinals, ordinals, numeral adverbs and distributive numerals.

1. Bura cardinal numerals

A cardinal numeral is a numeral of the class whose members are considered basic in form, used in counting and expressing how many objects are being referred to, as in:

Cardinal numeral

1	ntàng
2	sùdà
3	màkər
4	fwàr
5	ntìfù
6	nkwa
7	mùrfà
8	cisù
9	ùmthlà
10	kùmà
11	kùm kà ntànk
12	kùmjà sùdà
13	kùmjà màkər
14	kùmjà fwàr
15	kùmjà ntùfù
16	kùmjà kwà
17	kùmjà mùrfà
18	kùmjà cisù
19	kùmjà ùmthlà
20	súr kùmàrì
21	súr kùmàrì kà tànk
22	súr kùmàrì kà sùdà
23	súr kùmàrì kà màkər
24	súr kùmàrì kà fwàr
25	súr kùmàrì kà ntùfù
26	súr kùmàrì kà kwà
27	súr kùmàrì kà mùrfà
28	súr kùmàrì kà cisù
29	súr kùmàrì kà ùmthlà

30	màkùmàrì
31	màkùmàrì kà ntànk
32	màkùmàrì kà sùdà
33	màkùmàrì kà màkər
34	màkùmàrì kà nfür
35	màkùmàrì kà ntùfù
36	màkùmàrì kà kwà
37	màkùmàrì kà mùrfà
38	màkùmàrì kà cìsù
39	màkùmàrì kà ùmthlà
40	für kùmàrì
50	ntùf kùmàrì
60	kwà kùmàrì
70	mùrf kùmàrì
80	cìs kùmàrì
90	ùmthlà kùmàrì
100	àrù pàl
101	àrù kà tank
108	àrù kà cìsù
110	àrù kà kùmà
115	àrù kà kùmyà ntùfù
120	àrù kà sùrkùmàrì
130	àrù kà màkùmàrì
180	àrù kà cìskùmàrì
188	àrù kà cìskùmàrì kà cìsù
190	àrù kà umthlà kùmàrì
199	àrù kà ùmthlà kùmàrì kà ùmthlà
200	àrù sùdà
300	àrù màkər
400	àrù fwàr
500	àrù ntùfù
600	àrù kwà
700	àrù mùrfà
800	àrù cìsù
900	àrù ùmthlà
1,000	dùbù pàl
1,020	dùbù pàl kà sùrkùmàrì
1,300	dùbù pàl kà àrù màkər
2,000	dùbù sùdà
2,001	dùbù sùdà kà ntàng
2,111	dùbù sùdà kà àrù pàl kà kùmà tang
2,888	dùbù sùdà kà àrù cìsù kà cìs kùmàrì kà cìsù
3,000	dùbù màkər
4,000	dùbù fwàr
5,000	dùbù ntùf kùmàrì
6,000	dùbù kwà

7,000	dùbù mùrfà
8,000	dùbù cìsù
9,000	dùbù ùmthlà
1,0000	miliyàn tàng

From the foregoing, we observe that to form tens in the Bura language, the cardinal numerals from:

- a. 11 – 19 are preceded by the morpheme *kum-* “ten”.
- b. 21-29 are preceded by *súr kùmarì* “twenty”
- c. 31-31 are preceded by *màkùmarì* “thirty”

Important place values in the Bura numeral system are:

- a. *kùm-* ‘ten’
- b. *àrù* ‘hundred’
- c. *dùbù* ‘thousand’
- d. *miliyan* ‘million’ (borrowed from English or Hausa)

We also observed from the foregoing that in the counting system of Bura, all the cardinals, with the exception of *súr* “twenty” and *pál* “one” which have high tone, all the other cardinal numerals have low tone.

Bura ordinal numerals

The ordinal numerals, just like the adjectives, are used as attributes in sentences. They agree in gender and number with the noun they qualify. In Bura we observe that they are derived from the cardinal numerals through prefixation and suffixation processes. In order to form 1st to 20th the prefix morpheme *nà-* and suffix *-kùr* are added to the cardinal in order to have the ordinal, with the exception of first (1st) which uses a different stem from the cardinal numeral. While from 30th and above the morpheme *nà-* is prefix and *-kùmarì* is suffix to the cardinal in order to form the ordinal. Examples are provided below:

Bura ordinal numerals

<i>nà ntànkùmà</i>	1 st (first)
<i>nà sàdàkùr</i>	2 nd (second)
<i>nà màkəYrkùr</i>	3 rd (third)
<i>nà mfwàrkùr</i>	4 th (fourth)
<i>nà ntùfùkùr</i>	5 th (fifth)
<i>nà kwàkùr</i>	6 th (sixth)
<i>nà mùrfàkùr</i>	7 th (seventh)
<i>nà cìsùkùr</i>	8 th (eighth)
<i>nà ùmthlàkùr</i>	9 th (ninth)
<i>nà kùmkùr</i>	10 th (tenth)
<i>nà kùmkàtàngkùr</i>	11 th (eleventh)
<i>nà kùnyàsùdàkùr</i>	12 th (twelfth)

nà sùrkùmàkùr	20 th (twentieth)
nà màkə́Yrkùmàrì	30 th (thirtieth)
nà fwàrkùmàrì	40 th (fortieth)
nà ntùfùkùmàrì	50 th (fiftieth)
nà kwàkùmàrì	60 th (sixtieth)
nà mùrfàkùmàrì	70 th (seventieth)
nà cisùkùmàrì	80 th (eightieth)
nà ùmthlàkùmàrì	90 th (ninetieth)
nà àrù kùmàrì	100 th (one-hundredth)
nà dùbù kùmàrì	1,000 th (one- thousandth)

The foregoing reveals that *nà* occurs in the initial part of the number and *-kùr* at the end, from 2nd (second) up to 20th (twentieth). But in order to form 30th to million, the derivation process changes in the sense that *kumari* occurs word-finally. Similarly, there seems to be no tonal differences between the cardinal and the ordinal numerals; they all have low tones.

Bura numeral adverbs

English numeral adverbs are “once” “twice”, etc. In Bura, they are formed through the process of prefixation. This means that a morpheme *kà-* is added or prefixed to the cardinal numerals, as shown below:

Numerals adverbs

kà pál	once
kà sùdà	twice
kà màkər	thrice/three times
kà fwàr	four times.
kà ntùfù	five times
kà kwà	six times
kà mùrfà	seven times
kà cisù	eight times.
kà ùmthlà	nine times
kà kùmà	ten times

Gloss

We observe that there is another morpheme that is used to form the numeral adverbs in the language, although it is used frequently by the younger generation. It is rarely used by the older generation. The form is the *sò-*. We believe that it is borrowed from Hausa. It follows the same pattern observed above in numeral adverb formation with *kà-*. This situation is the same as in most other Chadic languages, such as Marghi (Hoffman 1963; Dlibugunaya 1988) Kilba and Miship (cf. Mu’azu 1995, 2003, 2009, 2010; Mu’azu and Isah 2010; Mu’azu and Katwal 2010).

Numerals adverbs

sò pál	once
sò sùdà	twice
sò màkər	thrice/three times

sò fwàr	four times.
sò ntùfù	five times
sò kwà	six times
sò mùrfà	seven times
sò cìsù	eight times.
sò ùmthlà	nine times
sò kùmà	ten times

From the foregoing, it is clear that the *kà-* and *sò-* which are used to signal adverb numerals in Bura are in free variation because they can be used interchangeably without affecting the meaning. The only difference is that the *kà-* is commonly used by the older people, while the *sò-* is used by the younger people.

Bura distributive numerals

Distributive numerals are special adnominal numerals that express distributive relation. In Bura, this type of numeral is formed through a process of reduplication. The cardinal numerals or numbers undergo the process of complete/total reduplication or partial reduplication (depending on certain variables) to form distributive numeral, as in:

Distributive numerals (Total reduplication)

tàng-tàng/pálpál	one each
sudá sudá	two each
makər makər	three each
mfwar mfwar	four each
mtifu mtifu	five each
nkwa nkwa	six each
murfa murfa	seven each
ncisu ncisu	eight each
umthla umthla	nine each
kuma kuma	ten each
kum ka ntang kum ka ntang	eleven each
kumya sudá kumya sudá	twelve each
kumya makər kumya makər	thirteen each
kumya mfwar kumya mfwar	fourteen each
kumya mtifu kumya mtifu	fifteen each
kumya nkwa kumya nkwa	sixteen each
kumya murfa kumya murfa	seventeen each
kumya ncisu kumya ncisu	eighteen each
kumya umthla kumya umthla	nineteen each
surkumari surkumari	twenty each
surkumari ka ntang surkumari ka ntang	twenty one each
surkumari ka sudá surkumari ka sudá	twenty two each
surkumari ka makər surkumari ka makər	twenty three each
surkumari ka mfwar surkumari ka mfwar	twenty four each
surkumari ka mtifu surkumari ka mtifu	twenty five each
aru aru	one hundred each

dubu dubu	one thousand each
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Numerals adverbs (Partial reduplication)

pápál	one each
sùsùdà	two each
màmàkər	three each
fwàfwà	four each
ntùntùfù	five each
kwakwa	six each
mùmùrfà	seven each
cìcìsù	eight each
ùmthlàùmthlà	nine each
kùma-kùmà	ten each

The two examples above in (5A) and (5B) shows that Bura distributive numerals can be formed through the process of complete and partial reduplication, although we observed that not all the cardinal numerals follow the rules of partial reduplication. There are a few exceptional cases as seen in Kwà-kwà “six each , ùmthlà-ùmthlà “ nine each” and Kùmà-kùmà “ten each” A part from these three all other cardinal numerals in the language follow the partial reduplication process in the formation of its distributive numerals. We observed that these phenomena operate in a similar manner in Marghi, Hausa and Kilba languages. See Hoffman (1963), Abubakar (2000) and Mu’azu (2009).

Finally, we wish to point out as well as state categorically that Chadic Languages numeral system in general as well as Bura system of numeration in particular is lagging behind in terms of linguistic studies/analysis. We hope that our pioneering effort will draw the attention of other scholars of Chadic languages and general linguist to the detailed and accurate scientific analytical description of Chadic languages, Nigerian languages and African languages system of numeration in general.

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Derivational Processes in the Igala Numeral System

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This paper investigates the derivational processes in the Igala numeral system. The study relies on three major sources in gathering the data for the descriptive analysis namely: compilation of relevant list of Igala numerals, the researcher's intuitive knowledge of the language in addition to his training as a linguist, and literature search. In Igala, the complexity of deriving, especially non-basic numerals involves addition and multiplication in addition to the grammatical processes; drawing from phonological, morphological and syntactic processes such as vowel elision, compounding, clipping, blending, reduplication, and sentential expressions that yield several numeral forms in the language. In all, from the available data in this study, Igala could be said to belong to the group of languages which have a vigesimal numeral system. This is because the language employs a numeral structure where counting is done majorly in multiples of ógwú/ògbò 'twenty'. In all, this paper may not be as exhaustive, but it is hoped that the study has achieved its primary aim of providing a detailed description of the derivational processes in the Igala numeral system in addition to helping the reader to appreciate the importance of this kind of research as it relates to typological considerations as well as universality of the grammar of numeracy in languages.

Keywords: Igala, numerals, vigesimal, derivational process, arithmetic, grammatical

1. Introduction

The Igala language belongs to the West Benue-Congo phylum (formerly part of Kwa) and is one of the 'Yoruboid' languages spoken in North Central Nigeria (Akinkugbe, 1976; 1978; Omachonu, 2000; 2002). It is a minority language spoken by about two million people who live on the eastern part of Kogi state covering nine (9) Local Government Areas of the State. It is under-documented and scantily described judging from the quantity and quality of documented and analysed/described data in it. Although one may argue that Igala is unlikely to be so endangered in the proper sense of the word considering the number of its native speakers and a pocket of linguistic researches available in the language (Armstrong, 1951, 1965; Omachonu, 2000, 2002, 2003a&b, 2006, 2007a&b, 2008; Atadoga, 2008; Ejeba, 2009; Ikani, 2010, etc.), one of the aspects always identified as being so seriously endangered in the use and study of the language is the numeral system (See Etu, 1999; Ocheja, 2001). This is because children nowadays hardly know how to count in Igala. Even adults, mix up Igala with Hausa and English when they count money and other objects in the language. A similar scenario was pointed out by Atóyèbí (nd.) of the numeral system of Ọkọ which he described as the most endangered aspect of the language because the act of counting in Ọkọ, according to him, has been left to older members of the community with the younger generation preferring to express numerals in the English language instead.

In the opinion of Comrie (2005; 2006), there are many instances of languages that are not particularly endangered, but whose numeral systems are endangered. According to him, language death is the result of social factors and numeral systems or counting generally is particularly susceptible to social factors. He illustrates this further (Comrie 2006:1):

A community encountering another community with greater numeracy may well borrow the “missing” parts of its system from that other community, but the contact may also involve replacements of parts or all of the existing system, and can also affect languages that come into contact even where there is no great difference in numeracy, but just cultural or commercial superiority of one group over the other.

This, one would agree with Comrie, explains why numeral systems are even more endangered than languages. It has therefore become imperative to document endangered numeral systems before they die out. It is to be noted that we are probably where we are today – a situation where so many numeral systems have died out to the point that what remains is only a pale reflection of the “human potential” with respect to numeral systems (Comrie, 2006) - because of lack of systematic and careful documentation of the numeral systems of many of our languages. Regrettably, Comrie (2006:1) concludes that given the present rate of death of languages in the world, “it may well no longer be possible even approximately to determine what the range of possible numeral systems in natural language is or to assess what the relative frequency of different types would be...”

Numeracy is a very important aspect of any linguistic system. Counting and or numbering is an integral and inseparable part of the grammar of any language because there is hardly any meaningful linguistic discourse in a language that does not make reference to quantity, size, time, distance and weight in definite numbers or numerals. As language changes following its dynamic nature, so do its contents, systems and patterns which counting is a part. Against this background, the aim of this study is to document and provide a detailed description of the Igala numeral system with a view to discussing the derivational processes involved and providing explanations for certain changes that have occurred in the system over time.

It is to be noted that in the presentation of data in this work, we made use of the standard Ígálà orthography (Miachi & Armstrong, 1986) as well as IPA symbols, especially where a word is rendered in phonetic transcription. Equally, with respect to tone marks, the acute accent [´] on a tone-bearing segment, usually a vowel represents a high tone, all instances where any particular vowel is not tone marked represents the mid tone, and the grave accent [`] on any tone-bearing segment represents a low tone.

Counting in Igala

Here, we shall limit our study of the numerical system of the language to counting from one (Ínyé [Ínɛ́]/ ókà) to a thousand (íchámù nyí ògwókò [íʃámùɲ`ɔgwɔ́'kɔ́]). It appears from all indications that the traditional counting system of Igala did not go beyond the figure one thousand (1000). Besides, for clarity of presentation, we shall

equally categorise Igala numerals into two broad groups as far as counting from one to a thousand is concerned. These are the basic numerals and the derivatives (See also Anagbogu, 2006). In clear terms, whereas the basics are the primary numerals which are mono-morphemic in nature, the derivatives are the secondary or non-basic numerals whose derivational history is traceable to a combination of the basic numerals through some addition, multiplication or a combination of both processes. Sometimes, these derivations in the Igala numerals involving mathematical manipulations could be very complex and cumbersome; hence, the proposals for modernization by some researchers on Igala numerals (Etu, 1999; Ocheja 2001), which we shall also present/review in the course of this discussion.

The Basic Numerals

In counting from one to a thousand in Igala, the following are considered as the basic numerals because as enunciated earlier, they are mono-morphemic and they are used for deriving the secondary numerals through some grammatical (phonological, morphological and syntactic) and or mathematical (addition and multiplication) processes.

(1): i. *Basic Numerals 1-10:*

1.	ínyé	[Íɲé]	or ókà [ókà]	“one”
2.	èjì	[èdʒì]		“two”
3.	ètā	[`etā]		“three”
4.	èlè	[`el`ε]		“four”
5.	èlú	[`elú]		“five”
6.	èfè	[`efà]		“six”
7.	èbiē	[èbjie]		“seven”
8.	èjō	[`edʒɔ]		“eight”
9.	èlá	[`elá]		“nine”
10.	ègwá	[`εgwá]		“ten”

ii. *Numerals 20, 50, 200, 400 and 800*

ógwú	[ógwú] or	ògbò [`ɔgb`ɔ]	“20”
óójē	[óódʒē]		“50”
ògwá	[`ɔgwá]		“200”
úlú	[úlú]		“400”
íchámù	[ítʃámù]		“800”

The Secondary or Non-Basic Numerals

As Anagbogu (2006) observed in respect of Koring, membership of this category is potentially uncountable and endless and could run into millions and even billions but what the analyst needs is a deliberate manipulation of the basic figures or numerals to arrive at more complex numerals by derivation and extension. In what follows, we shall present numerals in this group by sub-dividing them into the following sub-sets:

Numerals Derived by Addition of Two Basic Numerals

(2):

ègwá # ókà → ègwákà	ègwá # ẹfà → ègwẹfà
ten + one “eleven”	ten + six “sixteen”
ègwá # ẹ̀jì → ègwẹ̀jì	ègwá # ẹ̀biē → ègwẹ̀biē
ten + two “twelve”	ten + seven “seventeen”
ègwá # ẹ̀tā → ègwẹ̀tā	ègwá # ẹ̀jō → ègwẹ̀jō
ten + three “thirteen”	ten + eight “eighteen”
ègwá # ẹ̀lẹ̀ → ègwẹ̀lẹ̀	ègwá # ẹ̀lá → ègwẹ̀lá
ten + four “fourteen”	ten + nine “nineteen”
ègwá # ẹ̀lú → ègwẹ̀lú	ten + five “fifteen”

As could be observed from the above data, the derivation of 11 to 19 takes only the addition of the cardinal basic numerals 1-9 to base ten. The combination of any two basic numerals to derive another numeral, apart from the arithmetic process of addition, equally subscribes to a phonological process of vowel elision whereby the last vowel of the base numeral ten (ègwá) is elided and its tone transferred to the initial vowel of the following cardinal/basic numeral that combines with it except the first example, ègwá # ókà → ègwákà where the first vowel of the second word got elided instead. This is to be expected because even though the emerging central dialect of Igala prefers this form ègwákà, it is realized as ègwókà in Ibaji dialect. And this when carefully analyzed in the light of the derivation of the other examples will attest to the fact that the form ègwókà in Ibaji should have been the basic alternant of the form for numeral eleven in Igala language. Besides, another striking feature of the numerals in this category is that even though the sense addition is expressed, there is no overt addition morpheme to suggest that we add a basic numeral to another basic numeral to derive a secondary or non-basic form. Let's see the forms in 1.2.2. below for derivations involving the use of over conjunction or addition morpheme as against the examples in 1.2.1 .

Numerals Derived by Addition of Two Basic Numerals (21-29)

(3):

ógwú # nyí # òké # kà → [ógwúŋókēkà]	twenty-one
twenty plus sgl figure one	
ógwú # nyí # òké # mḕjì → [ógwúŋókēmḕd̪ʒì]	twenty-two
twenty plus sgl figure two	

ógwú # nyí # òké # mētā → twenty plus sgl figure three	[ógwúŋókēmētā]	twenty-three
ógwú # nyí # òké # mēlè → twenty plus sgl figure four	[ógwúŋókēmél`ε]	twenty four
ógwú # nyí # òké # mēlū → twenty plus sgl figure five	[ógwúŋókēmélū]	twenty five
ógwú # nyí # òké # mēfà → twenty plus sgl figure six	[ógwúŋókēméfà]	twenty six
ógwú # nyí # òké # mébiē → twenty plus sgl figure seven	[ógwúŋókēmébiē]	twenty seven
ógwú # nyí # òké # mējō → twenty plus sgl figure eight	[ógwúŋókēmédʒo]	twenty eight
ógwú # nyí # òké # mēlā → twenty plus sgl figure nine	[ógwúŋókēmélā]	twenty nine

Note that the full form of the word for plus “*nyi*” in Igala is “*manyu/manyi*” which means “in addition to”. It means that in deriving these forms, apart from the phonological process of vowel elision, there is also a morphological process of clipping as it affects the word *manyu/manyi* which gets reduced to “*-nyi*” with the first syllable chopped off; likewise the reduction of *ókà* to *kà* so as to blend with the other morphemes or words in order to achieve the derivation process involved in arriving at these numerals. In addition, the numerals are actually sentential when rendered in their full forms, e.g.:

ógwú # nyí # òké # kà = ógwú ki mányí(ú) ókà = “Let twenty be added to one”.

It is to be noted that some dialects of Igala, particularly Ibaji, uses both ọwọ “hand” and òké “single figure” interchangeably for counting in this context as demonstrated in (4) below:

(4): ógwú # nyí # ọwọ # kà → twenty plus hand one	[ógwúŋókēkà]	twenty-one
ógwú # nyí # ọwọ # mējì → twenty plus hand two	[ógwúŋókēmēdʒì]	twenty-two

ógwú # nyí # ówó # mētā → [ógwúŋókēmētā] twenty-three
 twenty plus hand three

ógwú # nyí # ówó # mēlè → [ógwúŋókēmél`ε] twenty-four
 twenty plus hand four

Numerals Derived by Multiplication in Multiples of Twenty (40, 60, 80, 100)

In the Igala counting system, the word *ógwú* (twenty) is synonymous with *ògbò* as pointed out earlier in 1(ii) above. Therefore, as we go into multiplication to derive higher numbers, preference is given to the use of *ògbò* in multiples of twenty to derive 40, 60 and 80, except in 100 where the two forms are used interchangeably. See examples as presented in (5) below:

Ògbò # mējì	= (20X2 or twenty in two places)	“forty”
Ògbò # mētā	= (20X3 or twenty in three places)	“sixty”
Ògbò # mēlè	= (20X4 or twenty in four places)	“eighty”
Ògbò (ógwú) # mēlū	= (20X5 or twenty in five places)	“hundred”

Numerals Derived by both Multiplication and Addition of Two Basic Numerals (30, 50, 70, 90)

For these, derivation takes both multiplication and addition except for 30 which takes only addition of two basic numerals. Let us consider the examples in the data below:

(6):

ógwú # ègwá → ógwú-ègwá [ógwú`εgwá] “thirty”
 twenty + ten

ètā # ègwá → ètègwá [`εt`εgwá] “seventy”
 20 x 3 + 10

èlè # ègwá → èlègwá [`εl`εgwá] “ninety”
 20 x 4 + 10

One may equally want to know what happens to the numeral fifty (50). It should be noted however that the form for fifty (50) in Igala, *óójē* [óóɔ̃ɛ̃] has no such derivational history as 30, 70 and 90 above. One unique thing about the numeral fifty in Igala is that it appears completely independent. It is neither derived by any other numeral(s) nor does it contribute to deriving other numerals in the language hence the proposal at a point in time to use the word *ólí* to represent a unit of fifty in the Igala counting system (Etu, 1999). This however did not gain popularity in the system for two reasons: It is only applicable to non-monetary numeration like counting heaps and ridges only among the farmers and secondly, it is only used to designate acceptably

300 (*óli mēfà* = 50 in six places) and 500 (*óli mēgwa* = 50 in ten places) respectively in the Igala traditional numerical system (See also Ocheja, 2001).

The Use of Ògwókó (Ògwá), Úlú, Íchámù and Íchámùnyōgwókó

Ògwókó (ògwá), úlú, íchámù and íchámùnyōgwókó which stand for 200, 400, 800 and 1000 respectively were derived or made popular when cowry was used as money in the Igala society. That is why these forms are closely associated with òkó (money) in their derivations.

(7): ògwá # òkó 200 money	→	Ògwókó	200
úlú # (òkó) 400 money	→	úlú(òkó)	400
íchámù 800	→	íchámù	800
íchámù # nyí # ògwókó 800 + 200	→	íchámùnyōgwókó	1000

From the data above, it could be observed that the numerals 200, 400, and 800; in fact, 200-900 do not refer to the basic numerals 2-9 as the bases for their derivation. So, it becomes very difficult to predict these forms and interpret them taking a cue from the basic cardinal numerals 1-9 as it is the case with English and other languages. A further investigation even reveals that the meanings of these forms: *ògwá*, *úlú* and *íchámù* are not inherently available in Igala. Again, the word *úlú* (400) is not as closely associated with money except when cowries were counted in bags and one would hear; *úlú àkpúlù*, meaning; four hundred bags of money which in the present dispensation – the era of naira, would mean only eighty thousand naira (N80,000). In the Ibaji dialect where yam farming is a major occupation, the bare forms *ògwá* and *úlú* would readily refer to 200 and 400 tubers or seedlings respectively.

Ordinal Numerals

The main function of ordinal numerals in Igala numeration is to indentify ranks within a hierarchy with a view to situating a noun referent in a particular hierarchical position. In Igala like other languages (See Stolz & Veselinova 2005; Anagbogu, 2006; Atóyèbí, nd.), ordinal numerals are derived from cardinal ones by attaching the prefix *èkó-* (“you are named or answered”) to a cardinal number except first *éjódùdu* (morning eye/sight, literal) meaning that which the eye sees first in the morning. Here, Igala like Ọkọ (See Atóyèbí, nd.) can be categorized under languages in which ‘first’ is suppletive, derivationally independent of the basic numeral ‘one’ in the language (See also Stolz & Veselinova 2005). Other numerals from ‘two’ upwards (ad infinitum) are derived by attaching the prefix *èkó-* to relevant cardinal numerals (with the required vowel elision).

(8):

ínyé	[ínɛ́] or ókà [ókà]	“one”	éjódùdu	“first”
èjì	[èdʒì]	“two”	èkéjì	“second”
ètā	[ètā]	“three”	èkétā	“third”
èlè	[èlè]	“four”	èkéèlè	“fourth”
èlú	[èlú]	“five”	èkélu	“fifth”
èfà	[èfà]	“six”	èkéfà	“sixth”
èbiē	[èbjīē]	“seven”	èkébiē	“seventh”
èjō	[èdʒō]	“eight”	èkéjō	“eightieth”
èlá	[èlá]	“nine”	èkélá	“ninth”
ègwá	[ègwá]	“ten”	èkégwá	“tenth”
ègwélū	[ègwélū]	“fifteen”	èkégwélū	“fifteenth”
ógwú	[ógwú]	“twenty”	èkógwú	“twentieth”

Distributive Numerals

Distributive numerals in the Igala counting system are derived from cardinal numerals primarily through only total/complete reduplication. This is unlike Anagbogu (2006) and Atóyèbí, (nd.) in Koring and Ọkọ respectively where deriving the distributive forms is achieved through either partial or completely reduplicated forms of the basic numerals. See the examples of distributive numerals in data (9, i & ii) below:

(9).i: ókà	“one”	ókà ókà	“one each/one-by-one”
èjì	“two”	èjì èjì	“two-by-two/in twos”
ètā	“three”	ètā ètā	“three-by-three/in threes”
èlè	“four”	èlè èlè	“four-by-four
èlú	“five”	èlú èlú	“five -by-five”
èfà	“six”	èfà èfà	“six -by-six”
ii: ọgbòmèjì	“forty”	ọgbòmèjì èjì	“forty-by-forty”
ọgbòmètā	“sixty”	ọgbòmètā ètā	“sixty-by-sixty”
ógwúmélū	“hundred”	ógwúmélū èlú	“hundred-by-hundred”

From the data above, it is clear that the derivation of distributive numerals goes through complete/total reduplications of the basic forms. For numeral 1, even though the form used here is *ókà* → *ókà ókà*, it does not mean *ínyé* cannot be used to derive *ínyé inyé* as the case may be; it is only that the use of *ókà* is sometimes preferred in this context due to its melody. It is to be noted also that in (9.ii) above, though the reduplication appears partial on the surface, it is in the real sense total because the point of emphasis is the figure that is used to effect the multiplication, e.g.: *èjì èjì*, *ètā*

ètā and so on whereas ógwú or ògbò (twenty) as the base is held constant in the derivation. Besides, there is nothing wrong with the forms: ògbòmējì ògbòmējì, ògbòmētā ògbòmētā and ógwúmélū ógwúmélū. It is only that for brevity and euphonic melody, preference is, in most cases, given to the forms that reduplicate only the numerals used to multiply the base as presented in (9.ii) above.

Proposals for Modernization of the Igala Numerals

Following the difficulties associated with representing certain clumsy numerals in Igala e.g. íchámùnyōgwókó mējì nyí ógwúmélū mējì nyí ògbòmélè-ègwá nyí òké mēlá (2,299) as well as those numerals identified with unclear derivational history, certain proposals for modernization were put forward. At present, I would review two of such proposals by Etu (1999) and Ocheja (2001). These two, even though they are not linguists, are native speakers of Igala who have had been associated with the study of Igala language at one point or the other.

Etu (1999) argues that young people especially Igala youths find it difficult to count in their mother tongue because they do not know the counting system of the language. According to him, people find it difficult to learn the unsystematic relationship between numerals 101-2000 because of its clumsy nature. Recall our earlier discussion on the following numerals: ògwókó (ògwá), úlú, íchámù and íchámùnyōgwókó as a point at issue here. As against ógwúmēchi for 700 and íchámùnyōgwókó for 1000, Etu proposed ógwú-mélū mébiē and ólíú respectively. He argues further to justify the proposal (p. 107): “ólíú is calculated with the concept of ólí which is 50 and twenty olis is 1000. *Oliu* means *oli ogwu*.” He observed, however, that the word *oliu* though short and easy to use, is yet to be made popular for acceptability. His conclusion therefore is that, for now, *oliu* can be used alternately with the more popular íchámùnyōgwókó for 1000 in Igala.

Another voice in this direction as it relates to proposals for modernizing some numerals in the Igala counting system is that of Ocheja (2001). Apart from coining the word íchányì for 1000, the major changes proposed by Ocheja include a departure from the traditional way of counting in multiples of hundreds from 200 – 1000 to counting in hundreds which translates into the differences between the traditional and the proposed as shown in (10):

OLD	PROPOSED	
ògwókó	ógwú-mélū mējì	200
ólí-méfà	ógwú-mélū mētā	300
úlú(ókó)	ógwú-mélū mēlè	400
ólí-mégwa	ógwú-mélū mēlū	500
úlú ògwá	ógwú-mélū mēfà	600
ógwúmēchi	ógwú-mélū mébiē	700
íchámù	ógwú-mélū mējō	800
íchámù	nyí ógwú-mélū/ógwú-mélū mēlá	900
íchámùnyōgwókó	íchányì	1000

The word íchányì, according to Ocheja, is his own derivation of the numeral 1000 from its traditional full form íchámùnyōgwókó taking a cue from the Yoruba *egbèrun* (1000) derived from *igba marun* which literally means 200 in five places.

One's opinion as far as these proposals are concerned is that it is one thing to come up with such elegant proposals but it is another to sell the ideas successfully to the end users. Therefore in issues like this, one may wish to suggest that we should do more of descriptive analysis of the linguistic systems of the language than being prescriptive, know full well that even our insistence can hardly change the situation. Besides, I don't see anything new about some of the proposals except the newly coined terms for 1000. If not, before now, some of us have been used to counting in hundreds from 200 to 1000 (See the appendix on Igala Numerals attached to this paper, page 17). However, one may wish to suggest that in dealing with higher figures or numerals such as million, billion, trillion and so on, the Igala could simply adopt a transliteration of the terms through borrowing to have ímílòìnù, íbílìònù and so on respectively.

7. Summary and Conclusion

Thus far, this paper has presented a detailed description of the derivational processes in Igala numeral system with explanations on the derivational history of certain numerals whose meanings are not very obvious in the language as well as certain changes that have occurred in the system over time. The study limits itself to counting from one (*inyé/ókà*) to a thousand (*íchámù nyí ògwókó*) with the claim that the traditional counting system of Igala did not go beyond the figure one thousand (1000). Besides, for clarity of presentation, Igala numerals were categorized into two broad groups: the basic numerals (1-10, 20, 50, 200, 400 and 800) and the derivatives or non-basic whose derivational history is traceable to a combination of the basic numerals through some addition, multiplication or a combination of both processes. It has been observed that the form for fifty (50) in Igala, *óójē* [*óódzē*] is somewhat peculiar because it has no such derivational history as 30, 70 and 90 and it appears completely independent as it is neither derived by any other numeral(s) nor does it contribute to deriving other numerals in the language.

Even though the orientation of this study is not comparative, a comparison of some of the findings of this study with similar studies would help us to appreciate the importance of this kind of research as it relates to typological considerations as well as universality of the grammar of numeracy in languages. For instance, unlike Yoruba and Ọkọ in which the complexity of deriving especially non-basic numerals involves subtraction in addition to multiplication and addition, in Igala only addition and multiplication are involved in addition to the grammatical processes observed earlier (drawing from phonological, morphological and syntactic processes that yield several numeral forms). Besides, while in Koring (Anagbogu, 2006) the derivation of most secondary numerals involves the use of overt conjunction or addition morpheme (even in deriving numerals 11-19), the derivation of such in Igala does not require the use of such obvious conjunction or addition morpheme. Again whereas distributive numerals would require either full or partial reduplication in Koring, Yoruba and Ọkọ (See

Anagbogu, 2006; Comrie, 2006 and Atóyèbí, n.d. respectively), such derivations in Igala would require only full reduplication.

In all, from the available data in this study, Igala could be said to belong to the group of languages which have a vigesimal numeral system. This is because the language employs a numeral structure where counting is done majorly in multiples of *ógwú/ògbò* 'twenty' (Comrie 2005). As indicated from the outset, the primary objective of this study is to contribute to the documentation and description of this most vulnerable aspect of Igala grammar by providing a detailed description of its numeral system. Though this report may not be as exhaustive, it is hoped that the study has achieved its primary aim of providing a detailed description of the derivational processes in Igala numeral system. Finally, it is hoped that subsequent or further research into the numeral system of Igala will include discussions on much more comprehensive descriptive grammar of the Igala numeral system and other related issues including expression of some arithmetic operations such as fractions, addition, subtraction, division, reference to time expressed in hours, days, weeks, months, years, etc. in the numeracy of the language.

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Appendix: Igala Numerals

1. Ínyé [Ínɛ́]	30. ógwú-ègwá [ógwú`ɛgwá]
2. èjì [èdʒì]	40. ógwú-mējì [ógwúmēdʒì]
3. ètā [`ɛtā]	50. óójē [óódʒē]
4. èlè [`ɛl`ɛ]	60. ògbòmētā [`ɔgb`ɔmētā]
5. èlú [`ɛlú]	70. ètègwá [`ɛt`ɛgwá]
6. èfà [`ɛfà]	80. ògbò-mélè [`ɔgb`ɔmél`ɛ]
7. èbiē [èbjīē]	90. èlègwá [`ɛl`ɛgwá]
8. èjō [`ɛdʒɔ]	100. ógwú-mélū/ògbòmélū [ógwúmélū/`ɔgb`ɔmélū]
9. èlá [`ɛlá]	200. ógwú-mélū mējì / ògwá/ ògwókó [`ɔgwa`ko´]
10. ègwá [`ɛgwá]	300. ógwú-mélū mētā [ógwúmélūmētā]
11. ègwákà [`ɛgwákà]	400. ógwú-mélū mélé [ógwúmélūmél`ɛ]
12. ègwējì [`ɛgwédʒì]	500. ógwú-mélū mēlū [ógwúmélūmélū]
13. ègwētā [`ɛgwētā]	600. ógwú-mélū mēfà [ógwúmélūmēfà]
14. ègwélè [`ɛgwél`ɛ]	700. ógwú-mélū mébiē [ógwúmélūmébiē]
15. ègwélū [`ɛgwélū]	800. ógwú-mélū mējō [ógwúmélūmédʒɔ] / íchámù
16. ègwéfà [`ɛgwélà]	900. ógwú-mélū mēlá [ógwúmélūmélà]
17. ègwébiē [`ɛgwébjīē]	1000. íchámùnyōgwókó [ítʃámùn`ɔgwa`ko´]
18. ègwējō [`ɛgwédʒɔ]	2000. íchámùnyōgwókó-mējì/[ítʃámùn`ɔgwa`ko´mēdʒì]
19. ègwélā [`ɛgwélā]	3000. íchámùnyōgwókó-mētā [ítʃámùn`ɔgwa`ko´mētā]
20. ógwú [ógwú]	4000. íchámùnyōgwókó-élè/[ítʃámùn`ɔgwa`ko´mél`ɛ]
21. ógwúnókēkà [ógwúnókēkà]	5000. íchámùnyōgwókó-mélū/[ítʃámùn`ɔgwa`ko´mélū]
22. ógwúnókēmējì [ógwúnókēmēdʒì]	6000 íchámùnyōgwókó-mēfà [ítʃámùn`ɔgwa`ko´mēfà]
23. ógwúnókēmētā [ógwúnókēmētā]	7000. íchámùnyōgwókó-mébiē [ítʃámùn`ɔgwa`ko´mébiē]
24. ógwúnókēmélé [ógwúnókēmél`ɛ]	8000. íchámùnyōgwókó-mējō [ítʃámùn`ɔgwa`ko´médʒɔ]

25. ógwúnókēmēlū [ógwúnókēmēlū]	9000. íchámùnnyōgwókó-mēlá [íṭṣámùn`ɔgwɔ'ko'mɛlá]
26. ógwúnókēmēfà [ógwúnókēmēfà]	1,000,000. íchámùnnyōgwókó-mégwa [íṭṣámùn`ɔgwɔ'ko'mégwa]
27. ógwúnókēmébiē [ógwúnókēmébiē]	2, 000,000. íchámùnnyōgwókó-mégwa mējì
28. ógwúnókēmējō [ógwúnókēmédʒɔ]	3,000, 000. íchámùnnyōgwókó-mégwa mētā
29. ógwúnókēmēlá [ógwúnókēmēlá]	4,000.000. íchámùnnyōgwókó-mégwa èlè

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Igbo Numerals, Measurement Systems and Pedagogy

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This paper is a review of the traditional numerals, counting and measurement systems in Igbo. The purpose is to ascertain the extent to which foreign values have encroached or eroded the Igbo traditional value systems. The paper also finds out how familiar Igbo children are with the Igbo numeral systems and measurement and what can be done to remedy perceived lapses through pedagogy. The paper discusses the relevance of the Igbo indigenous counting and measurement systems in enhancing learning capabilities of Igbo-speaking children, especially in mathematics-oriented subjects. The paper advocates the introduction of the Igbo numeral, counting and measurement systems into the curriculum adopted for teaching the Igbo language, especially at the basic stage of education. This calls for concerted efforts and more emphasis on the part of educational policy makers and implementers.

1. Introduction

All languages of the world have their own counting system. Sanusi (1995) asserts that each language has words that are used in counting. Sanusi (1995:13) further observes that

... the traditional system of counting, in any given speech community, constitutes one of the sociolinguistic factors that make up the distinctness and individuality of that speech community as against other speech communities.

There were well-established ways of counting and numeral systems in use by Igbos for various activities that revolved mostly around farming, before the coming of the whiteman. With the passage of time, however, the traditional vigesimal system gave way to the decimal system through language planning efforts. According to Ndukwe (1995:53),

A fairly radical restructuring of Igbo numerals has been carried out. The traditional vigesimal system was considered by the planning agents as being too cumbersome, and riddled with ambiguities, for effective use in the ongoing modernization of Igbo society. An alternative decimal system was substituted and claimed to render the Igbo counting system more amenable to technological use, especially as it relates to mathematics.

The Igbos also have their own system of observing days and months to keep record of time. This revolves around the appearance of the moon. Their counting of days is predicated on the market days that serve as outlet for disposing their farm produce, because as they are majorly preoccupied with agricultural practices. The Igbos also had their own standards and measurement systems. Some of these terms they used in past are still in use in some places but most of them have been eroded or lost entirely as a result of cross-cultural influences.

Numerals in some Nigerian languages

	<i>Bukpe</i>	<i>Igala</i>	<i>Tiv</i>	<i>Hausa</i>	<i>Yoruba</i>
1	obong	oka	moni	aya	meni
2	ifie	aji	uhwa	biyu	meji
3	itie	eta	utaa	uku	meta
4	ene	ele	unyii	hudu	merin
5	iza	elu	utaan	biyar	marun
6	etietie(3,3)	efa	aterata	shida	mefa
7	izarifie (5&2)	ebie	utankaauhwa	bokwaii	meje
8	binebine (4,4)	ejọ	anieni	takwas	mejo
9	(i)zaribine (5&4)	ela	utankaunyi	tara	mesan
10	rikwe	egwa	pue	goma	mewaa
20	risi	ogwu	kundu		ogun
40	asiafie	ogwu	meji		ogoji
100	asiazan	ogwu	melu		ogorun
400	asirisi		úlú		irinwo

Cardinal Numerals

	<i>Igbo (Isuochi Dialect)</i>	<i>Standard Igbo</i>
1	nna	otu
2	ibụọ	abụọ
3	itọ	atọ
4	inọ	anọ
5	ise	ise
6	ishii	isi
7	asaa (isaa)	asaa
8	satọ	asatọ
9	teghete	itoolu
10	iri (eri)	iri
11	iri na nna	iri na otu
18	iri na isatọ	iri na asatọ
20	ohu (ogụ)	iri abụọ
21	ohu na nna	iri abụọ na abụọ
28	ohu na isatọ	iri abụọ na asatọ
29	ohu na iteghete	iri abụọ na itoolu
30	ohu na iri	iri atọ
40	ohu ibụọ	iri anọ
50	ohu ibụọ na iri	iri ise
60	ohu atọ	iri isi
70	ohu atọ na iri	iri asaa
80	ohu anọ	iri asatọ
90	ohu anq na iri	iri itoolu
100	ohu ise (ohu lese)	nàrĩ
400	nnụ	narị anọ

800	nnụ labo	naṛi asato
1200	nnụ latọ	otu puku na naṛi abụo
2000	nnụ lese	puku abụo
4000	nnụ leri	puku anọ
1,000,000	-	ndè
1,000,000,000	-	ijèrì

The uncountable in the Igbo traditional counting system was referred to nnụ kwuru nnụ (400 upon 400), agụtaaguta, amakwuru, nnari (referring to the number of sand, aja mbu n'ala, that is the sand that lives in the ground). Ndukwe (1995:54) observes that “the Igbo number names beyond ten are analysed as phrases plus the appropriate numbers properly analysed (e.g. 216 consists of $(100 \times 2) + (10 \times 1) + (6)$ ”. In other words, once we count beyond ten what we now have is a combination of phrases and numbers to express certain values in the numbering system. However, Ndukwe (1995) notes that in the traditional numeral system (oḡu 20 and nnụ 400) entails a mathematically different kind of operation from the phrase node.

Ordinals

(Human)

1 st	onye nvụ
2 nd	onye ibụo
3 rd	onye itọ
4 th	onye inọ
5 th	onye ise
6 th	onye ishii
7 th	onye isaa
8 th	onye isato
9 th	onye iteghete
10 th	onye iri, etc.

(Non-human)

1 st	nke nvụ
2 nd	nke ibụo
3 rd	nke itọ, etc.

Igbo measurement systems

There are several traditional standards of measurement and measurement systems that exist among the Igbo people before they came in contact with the whites.

Palm oil measurement

Traditionally, palm oil is stored and measured in oḡa or eju; hence oḡa mmanụ or eju mmanụ. However, the Standard measurement of palm oil changed to bottle. Most of the time, the cylindrical green bottle of aromatic schnapps bottle or the green beer bottle and later the lucuzade bottle was added. For the Isuochi people, for higher

measurements they relied on the *ite Lọkpa*, that is the pottery made clay pot from *Lọkpa* but mainly sold at the *Isiagu* local market. The *ite nkpa* or *abaghụ* is an equivalent measurement of ‘Tin’. This the cylindrical tin ware used by the palm oil merchants to transport palm oil, especially from the east to the north. Three *ite Lọkpa* make one *ite nkpa* which is equal to a ‘tin’. Today, because of western influence, we no longer use these traditional standards. What is in vogue for measuring oil are all shades of bottles of various sizes. These bottles can be PET or glass based. The gallon system is also used whereby four litres make up a gallon. We now have gallons up to fifty litres.

These modern standards have taken over and eroded the traditional standards of measurements. The consequence is obvious, children of the new generation may not have the privilege of learning these Igbo lexical items since most of them are not in active use any longer. Some of these traditional terms reside mostly with the aged in the rural areas.

Palm wine measurement

The palm wine is a natural liquor of the Igbo people that has been with them for many centuries. The palm wine is produced and processed within the Igbo community; it is not imported unlike the schnapps or the *kaikai* liquor popular called *akpuruachia*. Hence, there are well-established measurement standards for the palm wine. The *okpokoro* or *awarịba* (gourd) is used directly for the palm wine tapping (*ikụ mmị*) and processing from the palm tree (*nkwu* or *akwu*) or the palm raffia tree (*ngwọ*). The same *okpokoro* is used as standard of measurement for the palm wine. *Okuko* is the traditional cup used in drinking palm wine. *Okuko* is a standard for determining the quantity of palm wine that is contained in the *okpokoro*. There are two sizes of *okpokoro* giving rise to *awarịba mmị ukwu* (*okpokoro mmị ukwu*, big palm wine gourd) and *awarịba mmị nta* (*okpokoro mmị nta*, small plam wine gourd). *Awarịba mmị ukwu* contains *okuko iri na nna* or *iri na ibụọ* (*iri na otu* or *iri na abụọ* in standard Igbo, eleven cups or twelve cups), while *awarịba mmị nta* contains *okuko teghete* (*itoolu* in standard Igbo, nine cups).

Another barrel of measurement for the palm wine is *ite oti* (oti’s pot). The name may have come from the designer of the pot or the first to have used it. *Ite* has two sizes, *ite oti nta* (small *ite oti*) and *ite oti ukwu* (big *ite oti*). *Ite oti nta* contains *okuko lasatọ* (*okuko asatọ*, eight *okuko*), while *ite oti ukwu* contains *okuko lerie na asato* (*okuko iri na asatọ*, sixteen *okuko*). There are also half measurements of the *ite oti* referred to as *uwa ite oti* (*okara ite oti*, half measure of *ite oti*). *Uwa* (*okara*) *ite oti ukwu* contains *okuko mmị lasatọ* (eight cups of wine), while *uwa ite oti nta* is *okuko mmị lanọ* (four cups of wine).

Standard and measurement for food items

The *oba* is used to measure and also display for sale such food items as rice, *akidi* (beans), pepper, melon, etc. *Nkata azorọ* (*Azorọ*’s basket) probably named after the man that designed the basket is used to measure and also display for sale such food items as *jigbo* (tapioca), maize etc. The basket is the smallest variety of basket available, it quite unique and special. The traditional baskets are generally used as

standards for measuring most food items. The *mmimi* is a form of basket which is flat used to spread wet food products in the sun to dry. It is also used as a standard for measurement. The content of the *mmimi* basket is an equivalent of the content of the standard basket. Consequently, *mmimi jigbo* (flat basket of tapioca) is equal to *nkata jigbo* (normal basket of tapioca).

Days and market days

Taa	–	today
Echi	–	tomorrow
Nwara + echi – nwarechi	–	next tomorrow
tontoro nwarechi	–	day following next tomorrow
tontoro tontoro nwarechi	–	the day following the day that follows next tomorrow

With *tontoro* concept, we can express oncoming days till infinity. The *tontoro* notion is derived from the idea of seniority; *ito* - ‘to be senior’. Traditionally, days are counted using the market days system. We have *Eke*, *Orie*, *Afo*, *Nkwọ*. The first day of the four days *izu* (week) is *Eke*, while the last is *Nkwọ*. The Igbo traditional month is twenty-eight days. This is regarded as one full course of the moon; hence, the concept of one moon (*otu onwa*) as a month.

These Igbo traditional market days and the other special ways of expressing days ahead may sound strange to some Igbo children or even to some adults because the modern ways of expressing days have taken over. However, it is worthy of note that the Igbo language is well-favoured than English in expressing days ahead. Observing days using the traditional market days have died a natural death owing to the currency of the modern method in use. It only survives in the hinterland and in some churches. Only some adult members of the communities where traditional system is still obtainable use them. The children are not familiar with the traditional days system. In all schools, it is stating the obvious that no attempt is made to use the traditional days system except when it is taught as a topic.

Tape measurements

The Igbos had a traditionally method of measurement length of objects, including land. They made use of their fingers and feet in taking measurements. The thumb in combination with the index finger spread apart from each other on surface gives us an *mgba aka* which is equivalent to about six inches in measurement. An *mgba aka* is the distance between the thumb and the index finger when spread far apart on a surface. The two feet when spread apart or a step gives us an equivalent of one metre. This what the Igbos traditionally call *otu nzo ukwu* (one step).

Standards in tape measurements

otu mgba aka	-	6 inches
mgba aka abuo	-	1 foot
otu nzo ukwu	-	1 metre

Summary and Conclusion

It is true that the mental picture that is conjured for the Igbo child that knows the word *iko* when it is mentioned is the modern cups of different shapes and kinds. The Igbo child may not know that *iko* actually existed in Igbo concept in a different form? The Igbos have *okuko*, which is the local cup used in drinking both water and wine. It is still in use today mostly for drinking palm wine.

The sharing spirit amongst the Igbo is always demonstrated when using the *okuko* to share palm wine from the *okpokoro* or *awariba* (gourd). The palm wine is served from the *okuko* until everybody has had their turn and it begins to go its round once again until the wine is exhausted.

Most African languages have 400 as the highest number whereby higher numbers can be expressed in the multiples of 400. The question that has been posed which is a research challenge is why do African languages share this numbering phenomenon and why is 400 the highest number. Most of the Nigerian languages that have values which are higher than 400 must have got them through language engineering. For instance, in the case of Igbo 100 – (*nari*) 1,000 (*puku*), million (*nde*), billion (*ijeri*) are later derivations; some of the concepts were used to name certain values in some dialects of Igbo, but were later adopted to name these special place values in the numeral system of the standard dialect. Ndukwe (1995) states that the inclusion of basic words representing 100, 1000, 1,000,000 and 1,000,000,000 are landmarks in the new decimal system. He comments on the pedagogic implications of the new system:

Whereas there is little doubt that the use of the ‘new’ numerals has permeated the educational system, for the print and electronic media as well as formal and public usage, an explicit picture is yet to emerge as to how far they have been adopted. But as time goes on and as increasing number of children are brought into the education system where they are exposed to new numerals, it is reasonably certain that they will completely replace the old counting system in the very near future (Ndukwe, 1995:55).

This prediction has of course been fulfilled to a great extent as most school age children are no longer familiar with the old numerals.

Furthermore, traditionally, a majority of the Nigerian languages when they count up to twenty, have their other numbers in multiples of twenty. Most of this inherent counting system is suggestive of the base system that we have in mathematics; hence, these traditional knowledge could be transferred to mathematics and other related subjects to enhance learning. Again if the students are familiar with the traditional tape measurements, it could facilitate teaching of the British or American standards. Besides, these traditional terms could help us develop the metalanguage for teaching science and technology. This is also a challenge to those that are saddled with the responsibility of developing the Igbo metalanguage to look into the dialects for already existing terms that could be adopted before looking up to borrowing or coinages.

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Counting Money in the Obimo Igbo

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Interest in language documentation has been on the increase in the past few years and has shed light on the extent of work yearning for attention, especially in the dialects. Most of the earlier language use patterns hitherto neglected have become interesting objects of study as efforts in language documentation aim to preserve these patterns. In line with this objective, this paper presents a descriptive account of money counting in Obimo dialect even today among the old uneducated people. Data for the study were obtained from a random sample of male and female informants between the ages of 45 and 80 by simply presenting different denominations of Nigerian naira to them and recording the names they call them. The denominations were first presented individually and then, in various combinations. The non-availability of lower denominations of naira, however, posed a problem to this method but was taken care of by the use of sharing method. This involves giving out a low denomination note (like five naira note) for sharing, and recording what they would name as their share of the money. Because the numeration mode is basically oral, our data presentation was by word-for-word translation.

Introduction

Counting system refers to the method of finding how much or how many by associating actions or words to a sequence of objects. It is speculated that counting began soon after humans developed language. Fingers and thumbs provided the nature's abacus and informed the decimal system which allowed most counting systems in history to be based on the number 10. Different cultural groups have developed and adopted a range of ways for representing numbers in accordance with their needs. While some cultures developed both number names and symbolic graphemes for representing numbers, most other cultures did not go beyond using specific words (number names) to represent numbers. Depending on what the base number is, a counting system can be binary (base 2), quaternary (base 4), quinary (base 5), sexagesimal (base 6), octal (base 8), decimal (base 10), duodecimal (base 12), and even vigesimal (base 20). In each of these bases, numbers are built up by repeated sign for each group of the relevant base (say 2) followed by another repeated sign for 1.

This paper describes the system of counting money in Obimo, a dialect of Igbo, spoken in Nsukka Local Government of Enugu state. The dialect was classified as belonging to the Northern Groups of Dialects (NGD) in Nwaozuzu (2008), and Northern/Waawa Igbo in Ikekeonwu (1987). This exercise was motivated by the need to document this heritage which is fast going into extinction having been known and is only currently used among the aged, while the younger generation has abandoned it and opted for the seemingly more elegant modern Igbo counting system. As a matter of fact, the system of counting in Obimo Igbo (henceforth OI) evokes some amusement because of the ubiquitous measure used to represent a small amount of money today. In other words, the counting system heightens the value of money and

makes younger generation of speakers think that the users of such measures actually exaggerate the value of naira. The truth is that these measures mirror the good old days when money really had value, a time when 10 kobo could be broken down into ten pieces, each of which able to buy more things than anyone can imagine today. Thus, this counting system could serve as a reminder of the long distance that the value of the Nigerian currency had travelled down to its current status. As a background to the subject of this discourse, it would be necessary to describe the number system in the dialect briefly for proper understanding of money counting system.

The number system

The number 10 was and is still the basis for the counting system of OI. This number system did not have any symbolic graphemes for writing it but only number names as presented below. The Arabic Numerals provide the glosses.

1. n̄bɔ̄/na↔n↔
2. E↑b̄ɔ̄
3. E↑t̄ɔ̄
4. E↑n̄ɔ̄
5. i↑se↔
6. i↑shi↔i↑
7. E↑sa↔a↑
8. E↑sa↔t̄ɔ̄
9. i↑te↔gna↔n↔
10. i↑p̄i↔
11. i↑p̄i↔ vE↑ na↔n↔ (10 + 1)
12. i↑p̄i↔ vE↑ E↑b̄ɔ̄ (10 + 2)
13. i↑p̄i↔ vE↑ E↑t̄ɔ̄ (10 + 3)
14. i↑p̄i↔ vE↑ E↑no↔ (10 + 4)
15. i↑p̄i↔ vE↑ i↑se↔ (10 + 5)
16. i↑p̄i↔ vE↑ i↑shi↔i↑ (10 + 6)
17. i↑p̄i↔ vE↑ E↑sa↔a↑ (10 + 7)
18. i↑p̄i↔ vE↑ E↑sa↔t̄ɔ̄ (10 + 8)
19. i↑p̄i↔ vE↑ i↑te↔gna↔n↔ (10 + 9)
20. o↔ηω↔
21. o↔ηω↔ vE↑ na↔n↔ (20 + 1)
22. o↔ηω↔ vE↑ E↑b̄ɔ̄ (20 + 2)
23. o↔ηω↔ vE↑ E↑t̄ɔ̄ (20 + 3)
- 30 i↑ri↔ na↔a↔t̄ɔ̄ (10 x 3)
- 40 i↑ri↔ na↔a↔n̄ɔ̄ (10 x 4)
- 50 i↑ri↔ na↔a↔se (10 x 5)
- 60 i↑ri↔ na↔a↔shi↔i↑ (10 x 6)
- 70 i↑ri↔ na↔a↔sa↔a↑ (10 x 7)

80	$i\uparrow ri \Leftrightarrow na \Leftrightarrow a \Leftrightarrow sat\grave{o}$	(10 x 8)
90	$i\uparrow ri \Leftrightarrow na \Leftrightarrow a \Leftrightarrow te \Leftrightarrow gna \Leftrightarrow n \Leftrightarrow$	(10 x 9)
100	$i\uparrow na \uparrow ri \uparrow$	
110	$i\uparrow na \uparrow ri \uparrow E \uparrow i\uparrow ri \Leftrightarrow$	(100 + 10)
120	$i\uparrow na \uparrow ri \uparrow E \uparrow o \Leftrightarrow hwu \Leftrightarrow$	(100 + 20)
150	$i\uparrow na \uparrow ri \uparrow E \uparrow i\uparrow ri \Leftrightarrow na \Leftrightarrow a \Leftrightarrow se$	(100 + 10 x 5)
200	$i\uparrow na \uparrow ri \uparrow na \Leftrightarrow a \uparrow b\grave{o}$	(100 x 2)
300	$i\uparrow na \uparrow ri \uparrow na \Leftrightarrow a \Leftrightarrow t\grave{o}$	(100 x 3)
700	$i\uparrow na \uparrow ri \uparrow na \Leftrightarrow a \Leftrightarrow sa \Leftrightarrow a \uparrow$	(100 x 7)
1000	$a \Leftrightarrow dii \Leftrightarrow shi \Leftrightarrow$	(no terminal/indefinite)

The counting system above reveals that the dialect under study has thirteen basic number names from which other numbers are computationally derived. These are the number names for 1 to 10, 20, 100 and 1000. Both addition and multiplication are used to build up the non-basic numbers. The mathematical signs are expressed in the words $nE\uparrow$ (and), and $na \Leftrightarrow$ (times) which vowel sound assimilates the first vowel sound of the number word to which it is prefixed to create a long vowel. Thus, while 13 is $i\uparrow ri \Leftrightarrow nE\uparrow E\uparrow to \Leftrightarrow$ (10 and 3), 30 is $i\uparrow ri \Leftrightarrow na \Leftrightarrow a \Leftrightarrow t\grave{o}$ (10 times 3).

Money counting

Counting money in OI simply has to do with the process of measuring the quantity or amount of money through the use of number names. It follows the pattern described above except certain differences in some basic number names. There are fourteen basic number names in this money counting system. They are presented below:

1. Basic money counting number names

NGN	OI	
1k	$ko \Leftrightarrow b\grave{o} / E \Leftrightarrow \kappa \pi \Leftrightarrow p \Leftrightarrow$	one kobo
	kobo/ seed kobo	
2k	$ko \Leftrightarrow b\grave{o} na \Leftrightarrow a \uparrow b\grave{o}$	two kobo
	kobo times two	
3k	$ko \Leftrightarrow b\grave{o} E \uparrow to \Leftrightarrow / to \Leftrightarrow ro \Leftrightarrow$	three kobo
	kobo three	
4k	$ko \Leftrightarrow b\grave{o} E \uparrow no \Leftrightarrow$	four kobo
	kobo four	
5k	$ko \Leftrightarrow b\grave{o} i\uparrow se \Leftrightarrow$	five kobo
	kobo five	
6k	$ko \Leftrightarrow b\grave{o} i\uparrow shi \Leftrightarrow i\uparrow / shi \Leftrightarrow shi \uparrow$	six kobo
	kobo six	
7k	$ko \Leftrightarrow b\grave{o} E \uparrow sa \Leftrightarrow a \uparrow$	seven kobo
	kobo seven	
8k	$ko \Leftrightarrow b\grave{o} E \uparrow sa \Leftrightarrow t\grave{o}$	eight kobo
	kobo eight	
9k	$ko \Leftrightarrow b\grave{o} i\uparrow te \Leftrightarrow gna \Leftrightarrow n \Leftrightarrow$	nine kobo

	koβo vivε	
10k	o↑f↔↔ e↔go one money	ten kobo
N1	e↔go iri↔ money ten	one naira
N2	o↔g↔↔□ e↔go twenty money	two naira
N40	u↔nu↑ e↔go four hundred money	forty naira
N200	a↑kpa↔ e↔go bag money	two hundred naira

The number name for one is *na↔n↔↔* (*na↔a* for short). The use of *o↑f↔↔* as an alternative name suggests an influence from other dialect areas, for in emphatic discourse, aged OI speakers often use *E↔kp↔↔r↔↔ ego*.

The quantity of money expressed in the number names for N2 (*o↔g↔↔□ e↔go*), N40 (*u↔nu↑ e↔go*) and N200 (*a↑kpa ego*) is measured in terms of the number of 10k (*o↑f↔↔ ego*) in each number name. Thus, while ten pieces of ten kobo make N1 (*e↔go↔ iri↔*), twenty pieces make N2 (*o↔g↔↔□ e↔go*), and while four hundred pieces make up N40 (*u↔nu↑ e↔go*), two thousand pieces make up N200 (*a↑kpa ego*). Amounts between these basic numbers are derived through mathematical computation involving additions and multiplications, as can be seen in the data below:

Derivation of amounts with secondary number names

Data 2a

11k kobo	o↑f↔↔ e↔go nE↑ E↔kp↔↔p↔↔ ko↔bò one money and seed kobo	eleven
12k	o↑f↔↔ e↔go nE↑ ko↔bò na↔a↑bò one money and (kobo times two)	twelve kobo
20k	e↔go na↔a↔bò money times two	twenty kobo
30k	e↔go Eto↔ money three	thirty kobo
40k	e↔go Eno↔ money four	forty kobo
50k	e↔go ise↔ money five	fifty kobo
60k	e↔go ishi↔i↑ money six	sixty kobo
70k	e↔go Esa↔a	seventy kobo

	money seven	
80k	e⇔go Esa⇔tọ	eighty kobo
	money eight	
90k	e⇔go ite⇔gna⇔n⇔□□□□	ninety kobo
	money nine	
N1	e⇔go iri⇔	one naira
	money ten	
N1.10k	e⇔go iri⇔ nE↑ na⇔a⇔n⇔	one naira ten kobo
	money ten and one	
N1.20k	e⇔go iri⇔ nE↑ E↑bọ	one naira twenty kobo
	money ten and two	
N1.22k	e⇔go (iri⇔ nE↑ E↑bọ) nE↑ ko⇔bọ↑ na⇔a↑bọ	one naira twenty
two kobo	money (ten and two) and (kobo times two)	
<i>Data 2b</i>		
N2	ọg⇔⇔□ e⇔go	two naira
	twenty money	
N3	ọg⇔⇔□ e⇔go nE e⇔go iri⇔	three naira/thirty
kobo	twenty money and money ten	
N3.30k	ọg⇔⇔□ e⇔go nE↑ e⇔go iri⇔ nE↑ E↑to⇔	three
naira, thirty kobo	twenty money and money ten and three	
N4	ọg⇔⇔□ e⇔go na⇔a↑bọ	four naira
	twenty money times two	
N5	ọg⇔⇔□ e⇔go na⇔a↑bọ nE↑ e⇔go iri	five naira
	twenty money times two and money ten	
N6	ọg⇔⇔□⇔ e⇔go Etọ	six naira
	twenty money three	
N7	ọg⇔⇔□ e⇔go Etọ nE↑ e⇔go iri	seven naira
	twenty money three and money ten	
N8	ọg⇔⇔□⇔ e⇔go Enq	eight naira
	twenty money four	
N9	ọg⇔⇔□ e⇔go Enọ nE↑ e⇔go iri	nine naira
	twenty money four and money ten	
N10	ọg⇔⇔□ e⇔go ise	ten naira
	twenty money five	
N12	ọg⇔⇔□ e⇔go ishii↑	twelve naira
	twenty money six	
N20	ọg⇔⇔□ e⇔go iri	twenty naira
	twenty money ten	

N30	$\acute{o}g\leftrightarrow\leftrightarrow\Box e\leftrightarrow go\ iri\ nE\uparrow i\uparrow se\leftrightarrow$ twenty money ten and five	thirty naira
<i>Data 2c</i>		
N40	$\grave{u}\leftrightarrow n\grave{u}\uparrow e\leftrightarrow go$ four hundred money	forty naira
N50	$\grave{u}\leftrightarrow n\grave{u}\uparrow e\leftrightarrow go\ nE\uparrow o\leftrightarrow g\leftrightarrow\leftrightarrow e\leftrightarrow go\ ise$ twenty twenty money & twenty money five	fifty naira
N80	$\grave{u}\leftrightarrow n\grave{u}\uparrow e\leftrightarrow go\ na\leftrightarrow a\uparrow b\grave{o}$ twenty twenty money times two	eighty naira
N120	$\grave{u}\leftrightarrow n\grave{u}\uparrow e\leftrightarrow go\ Et\grave{o}$ twenty twenty money three	hundred & twenty naira
<i>Data 2d</i>		
N200	$a\uparrow kpa\leftrightarrow e\leftrightarrow go$ bag money	two hundred naira
N400	$a\uparrow kpa\leftrightarrow e\leftrightarrow go\ na\leftrightarrow a\uparrow b\grave{o}$ bag money times two	four hundred naira
N1,000	$a\uparrow kpa\leftrightarrow e\leftrightarrow go\ ise$ bag money five	one thousand naira
N2,000	$a\uparrow kpa\leftrightarrow e\leftrightarrow go\ iri$ bag money ten	two thousand naira
N4,000	$o\leftrightarrow hwu\leftrightarrow a\uparrow kpa\leftrightarrow e\leftrightarrow go$ twenty bag money	four thousand naira
N5,000	$o\leftrightarrow hwu\leftrightarrow a\uparrow kpa\leftrightarrow e\leftrightarrow go\ nE\uparrow i\uparrow se\leftrightarrow$ thousand naira	five
N6,000	twenty bag money and five $i\uparrow ri\leftrightarrow a\uparrow kpa\leftrightarrow e\leftrightarrow go\ na\leftrightarrow a\leftrightarrow t\grave{o}$	six thousand
N7,000	ten bag money times three $i\uparrow ri\leftrightarrow a\uparrow kpa\leftrightarrow e\leftrightarrow go\ na\leftrightarrow a\leftrightarrow t\grave{o}\ nE\uparrow i\uparrow se\leftrightarrow$ seven thousand naira	
N8,000	ten bag money times three and five $i\uparrow ri\leftrightarrow a\uparrow kpa\leftrightarrow e\leftrightarrow go\ na\leftrightarrow a\leftrightarrow n\grave{o}$	eight thousand
N20,000	ten bag money times four $\grave{ı}na\uparrow r\grave{i}\ a\uparrow kpa\leftrightarrow e\leftrightarrow go$ hundred bag money	twenty thousand naira
N40,000	$\grave{ı}na\uparrow r\grave{i}\ a\uparrow kpa\leftrightarrow e\leftrightarrow go\ na\leftrightarrow a\uparrow b\grave{o}$ hundred bag money times two	forty thousand

N100,000	a↔dị	i↔shi↔ a↗kpa↔ e↔go	hundred
thousand naira			
	pref-be-Neg	head bag money	‘indefinite/unlimited bags of money’

The data above reveal two basic computational operations used in the derivation of amounts with secondary number names as addition and multiplication. These operations are employed in deriving numbers between the number names as follows:

- i. 10k and N1.99k
- ii. N2 and N39
- iii. N40 and N199
- iv. N200.00 and infinity

i. *Counting 10k to N1.99k*

Money in this category goes by the name *ego*, and the counting starts with the very first number one such that 10k is *o↗f↔ e↔go* (one money). The incremental pattern is by both multiplication and addition. Equals, measured in units of one (*o↗f↔*), are multiplied in arithmetical progression expressed obviously only in the second, while others are implied. Fractions are indicated by addition. Hence, using this method, N1.99k, the upper limit of this measure, would be *e↔go↔ (iri nE↗ i↗te↔gna↔a↔n↔) nE↗ ko↔bò i↗te↔gna↔a↔n↔*. This by simple calculation implies ‘one money into nineteen places plus nine kobo’ (10k x 19 + 9k). See data 2a.

ii. *Counting N2 to N39*

The unit of counting in this category is *o↔g↔ e↔go* (twenty money). Here money is counted in multiples of twenty money (N2), and fractions are expressed by addition using the method for amount lower than this unit discussed above. For instance, N3.30k is ‘*o↔g↔ e↔go nE↗ e↔go iri↔ nE↗ E↗to↔*’, indicating that there is only a single unit of ‘*o↔g↔ e↔go*’ (twenty money) to which some fractions represented by ‘*e↔go iri↔ nE↗ E↗to↔*’ (ten money + three money) is added. Where each ‘ten money’ refers to N1. In N5 (*o↔g↔ e↔go na↔a↗bò nE↗ e↔go iri*), there are two units of ‘*o↔g↔ e↔go*’ (twenty) represented overtly in a double unit by the prefix *na↔* (times). The initial vowel of the multiplier assimilates to the vowel of the prefix to create a long vowel as in *na↔a↗bo↗* (times two), and covertly in higher units (*o↔g↔ e↔go Eto*, N6). The multiplicand and the multiplier appear in a linear order. See data 2b.

iii. *N40 and N199*

The unit of counting here is N40 (*u↔nu↗ e↔go*). As mention earlier, the number name represent an amount of money measured in terms of the quantity of 10k therein. Again both addition and multiplication are used to compute units and fractions of units in the pattern described for the preceding unit above. For instance, N50 is

$u \Leftrightarrow nu \Uparrow e \Leftrightarrow go \ nE \Uparrow o \Leftrightarrow g \Leftrightarrow \square \ e \Leftrightarrow go \ ise \ (N40 + N2 \times 5)$. Counting here ends in four units of the number name, such that after the relevant fractions, the fifth unit culminates in the next basic number name. In other words, the last derived number here is $u \Leftrightarrow nu \Uparrow \ e \Leftrightarrow go \ E \Leftrightarrow vo \ \bar{n}E \ o \Leftrightarrow g \Leftrightarrow \square \ e \Leftrightarrow go \ (iri \ nE \Uparrow i \Uparrow te \Leftrightarrow gna \Leftrightarrow a \Leftrightarrow n \Leftrightarrow) \ nE \Uparrow e \Leftrightarrow go \ iri \ (N40 \times 4 + (N2 \times (10 + 9)) + N1)$. See data 2c.

iv. N200 to infinity

N200 constitutes the basic unit of counting here. Fractions are computed through addition, while multiples are achieved by multiplication which follows previous patterns. However, unlike previous units, this unit measures up to infinity. This makes for computation of this unit both in units and tens to generate higher secondary number names up to infinity. Hence, computing in units follows the pattern described above but that of tens manifestly represents the multiplication prefix, but this time, a double of this unit in tens has a separate name $o \Leftrightarrow hwu \Leftrightarrow a \Uparrow kpa \Leftrightarrow ego$ (twenty bag money). See the data in (2d) above.

Conclusion

This paper has initiated a process of documenting Obimo Igbo counting system with a focus on money counting. It is observed that like most traditional counting systems, Obimo Igbo money numeration is a complex process involving a higher level of computation than is present in the modern decimal counting system. Cumbersome as it may be described, this counting system preserves the good old value system of our currency inherited from the currency of the colonial master (Britain) and gives an indication of the extent of depreciation our naira has experienced over the years. Again that the younger generation finds it difficult to use this counting system is a result of the growing decline in manual mathematical permutations observed in contemporary society due to overdependence on machine calculations.

Conventions and acknowledgements

- i. High [$\Leftrightarrow$] and low [$\Uparrow$] tones are marked in this paper, while the downstep is unmarked.
- ii. The dialect has a nine phonemic vowel system and a schwa believed by some analyst to have +/-ATR variants. The phonetic symbols [E] $\alpha \nu \delta$ [$\Leftrightarrow$] are used for the close mid front vowel and the schwa respectively in the absence of a standard letter for them in Igbo orthography.

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On the System of Numeration in Efik

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This paper is a response to Olderoge 1984 that Efik does not have a system of number beyond one thousand, since according to the claim, the word for thousand in Efik is *tosin*, which is borrowed recently from English and assimilated phonologically to synchronise with Efik. We dispute this position and argue that Efik can count up to a million and beyond internally, and that borrowing is not meant to enrich the internal resourcefulness of the language in this case, but merely for ease of pronunciation. In this paper, we also examine the structure of the system of cardinal numbers and the processes of forming complex numbers in Efik. All numbers in the language are derived from the basic units which are 1-5, 10, 15 and 20. Complex numbers are formed from addition, subtraction or multiplication of these basic units or a combination of addition and multiplication and/or subtraction. *Ye* is the particle for addition, *-suk* is the subtraction marker and multiplication is indicated by a zero allomorph. The general pattern of numeration in Efik is iterative. Our assumption is that the analyses of the system of number in Efik have some linguistic implications as it triggers certain grammatical phenomena in the language.

Introduction

An important subset of the concept of literacy is the skill of numeracy, which entails an ability to understand and work with numbers. People do not necessarily require to be literate to possess the skill of numeracy or understand counting operations in a given language. Every language community has its system of number, which is acquired as a part of the overall language acquisition/learning process. This knowledge enables an individual to function effectively in the society, especially in meeting the daily demands of social life, which include among other things representation of amount or quantity, account number for banking transactions, telephone number for day-to-day contacts, and even in locating residential addresses, hotel rooms or office accommodation. In this concern, numeracy is an important subcomponent of functional literacy.

The academic relevance of numeral system cuts across a wide range of disciplines such as philosophy, mathematics, history, archeology, anthropology and linguistics among others. The study of the system of numbers and counting operations in Nigerian languages has not attracted enormous research interest among scholars in spite of the overwhelming relevance of number to our civilization. Special knowledge relating to numbers and counting system in the indigenous languages are lacking in our young and up-coming generations, particularly, those living in the cities. In this way, an important aspect of our language and culture are exposed to the threat of extinction. This paper aims to safeguard the Efik language in this respect and awaken interest, notably in a cultural element (like the system of numeration), conveyed by the language which has been put out of prominent use. It is on the basis of this observation we suggest that the government should integrate numeracy in indigenous languages into the primary school curriculum and the National Mass and Adult

Literacy framework for achieving the much touted quality standard and quality assurance in basic education in Nigeria.

In this paper, we investigate the structure of the system of numbers in Efik, a Lower-Cross language spoken predominantly in Southern Cross River State, Nigeria. In this language, we examine the representation of number in quantity and amount, the system of forming complex numbers, counting operations, the grammatical processes that can be signalled by number derivation in addition to the syntactic representation of number. In the discussion that follows, we describe the structure of number with particular emphasis on quantity.

The structure of numbers (quantity)

Efik exhibits positional numeral system in which case each position relates with the basic unit by subtraction, addition and/or subtraction value representation. According to Ore (1988:16), the positional systems are based upon the principle of local value, so that a symbol designates a value or class which depends on the place it takes in the numeral representation. The basic units of number or the lexical numeral in the language are as follows:

1.	
kíét	‘one’
í bá	‘two’
íta	‘three’
ínáñ	‘four’
ítíón	‘five’
dúóp	‘ten’
éfit	‘fifteen’
édíp	‘twenty’

It is from these units that every other number that constitutes the complex numeral in the language is derived by the process of addition, subtraction or multiplication of a basic unit with another. For instance, the numbers 6-9 are derived as follows:

2(a) ítíón yé kíét five and one	→	(5 + 1) ítiókíét	‘six’
(b) ítíón yé í bá five and two	→	(5 + 2) itiábá	‘seven’
(c) ítíón yé í tá five and three	→	(5 + 3) ítiáíta	‘eight’
(d) (dúóp)súk- kíét ten less one	→	(10 - 1) úsúk- kíét	‘nine’

The derivation strategy here especially in 2(a) – (c) is basic unit + Xy. These numbers are formed by segment deletion of the final consonant of the basic unit in the case of (a) and the final syllable in (b) and (c), which are substituted with the low central vowel /a/. 2(b) also involves the deletion of the initial vowel sound of the following unit of number. The particle *ye* which indicate addition is completely deleted in the derivation. In 2(d), *úsúk-kíét* ‘nine’ has the value one less than the value of a base. The remainder is the value of the derived number. The numbers 11-14 are derived as follows:

3 (a) dúóp yé kíét → (10 + 1) dúóp ekíét
 ten and one
 ‘eleven’

(b) dúóp yé íbá → (10 + 2) dúóp ebá
 ten and two
 ‘twelve’

(c) dúóp yé itá → (10 + 3) dúóp etá
 ten and three
 ‘thirteen’

(d) dúóp yé ínáñ → (10 + 4) dúóp enáñ
 ten and four
 ‘fourteen’

Here, the number derivation is structured by an additive system of decimal representation of two bases. We have seen that the addition particle *ye* has its consonant /y-/ completely deleted in the derivation. In 3(a)-(d) the *e* sound functions as an epenthetic vowel. It brings about the elision of the first vowel of the root words, which is mainly high front vowel /i/. This same counting operation is used to derive the numbers 16-19.

4

(a) éfit yé kíét → (15 + 1) éfit ekíét
 fifteen and one
 ‘sixteen’

(b) éfit yé íbá → (15 + 2) éfit éba
 fifteen and two
 ‘seventeen’

(c) éfit yé itá → (15 + 3) éfit éta
 fifteen and three
 ‘eighteen’

-
- (d) éfit yé ínáñ → (15 +4) éfit énañ
 fifteen and four
 ‘nineteen’

From the number 20-39 involves the addition of the number 1-19 to twenty. However, the derivation of the numbers 40, 60 and 80 take different counting operations:

5

- (a) àbà - (2 x 2 x 10) fourty
 (b) átá - (3 x 2 x 10) sixty
 (c) ánáñ - (4 x 2 x 10) eighty

This counting system involves both addition and multiplication of basic units by the power of base 10, that is, (10^{x+x}) . Àbà is derived from *iba* ‘two’ *ata* from *ita* ‘three’ and *ánáñ* from *ínáñ* ‘four’. The replacement of the initial vowels of these elements from /i/ - /a/ implies the doubling of the units which are then multiplied by 10 to achieve the derivation. From the numbers 41-59, 61 – 79 and 81-99 involve the addition of the numbers 1-19 to the units of 40, 60 and 80 respectively. However, the derivation of 100 is somehow different from the above operation.

6. íkíé → kíét (1 x 10 x 10)
 ‘one hundred’

Íkíé ‘one hundred’ is clearly derived from *kíét* ‘one’. The phonological operation involves the deletion of the coda consonant in *kiet* and the insertion of the initial vowel in *íkíé*. The counting operation continues by adding 1-99 until we derive 200 - 999.

We disagree with Olderoge (1984) who argues that the numeration system of Efik developed only in the 19th century because of the use of the word ‘*tosin*’ for 1000, which he feels is an adoption of the English word ‘thousand’. Thousand in Efik counting system is also a derivation from the basic units:

- 7(a) íkíé dúóp (100 x 10)
 hundred (by) ten
 ‘one thousand’

The multiplication particle, which is indicated by zero allomorph is used to differentiate between a thousand and a hundred and ten:

- (b) íkíé yé dúóp (100 +10)
 hundred and ten
 ‘one thousand and ten’

We posit that the adoption of the form ‘tosin’ is simply for economy but not as a result of absence of equivalence vocabulary. The system of number can hardly be separated from the history of the people. Granted that as early 15th century, the Efik had had contact with Portuguese supercargoes, and manilla was identified as the currency in use side by side with the barter economy, which was a dominant practice. The Efik could not just have adopted English ‘tosin’ to develop its system of numeration. We can only accept this claim if the million is involved. The Efik number operation can be constructed up to nine hundred thousand, nine hundred and ninety nine. Million is certainly a recent adoption. The general view is that the people did not have the need for such extensive and advanced counting operations. They could however count up to several millions if need aptly arises. Other complex number derivation in Efik can be seen as follows:

8. Complex number

1,001 → íkié dúóp yé kíét hundred (by) ten and one ‘one thousand and one’	<i>Extended form</i> (100 x 10 + 1)
1,070 → íkié dúóp yé átá yé duop hundred (by) ten and sixty and ten ‘one thousand and seventy’	(100 x 10 + 60 + 10)
1,100 → íkié dúóp yé íkié hundred (by) ten and one ‘one thousand one hundred’	(100 x 10 + 100)
2,000 → íkié édíp hundred (by) twenty ‘two thousand’	(100 x 20)
5,000 → íkié ánáñ yé dúóp hundred (by) forty and ten ‘five thousand’	(100 x 40 + 10)
10,000 → íkié íkié hundred (by) hundred ‘ten thousand’	(100 x 100)
100,000 → íkié íkié dúóp hundred (by) hundred (by) ten ‘one hundred thousand’	(100 x 100 x 10)
200,000 → íkié íkié édíp hundred (by) hundred (by) twenty ‘two hundred thousand’	(100 x 100 x 20)

500,000→	íkié íkié yé àbà yé dúóp hundred (by) hundred and fourty and ten 'five hundred thousand'	(100 x 100 + 40 + 10)
900,000→	íkié íkié yé ánáñ yé dúóp hundred (by) hundred and eighty and ten 'nine hundred thousand'	(100 x 100 + 80 + 10)
999,999→	íkié íkié yé ánáñ yé dúóp énáñ hundred (by) hundred and eighty and niteen 'nine hundred thousand nine hundred and ninety nine'	(100 x 100 x 80 + 19)

3. Counting Amounts

They are different patterns of counting amounts depending on which currencies are involved. The former system of counting is gradually giving way to the modern method, which seems to follow directly the counting system of the language. For the purpose of our discussion, we review the two patterns. During the era of slave trading and pre-colonial administration of Efikland, trade by barter was a popular means of exchange of goods and services. This system is still prevalent in parts of Efikland, especially Esuk Mba in Akpabuyo Local Government Area of Cross River State. The system has been very unpopular given the principle of coincidence of wants. No currency is involved. One only needs to count the commercial items, whose values are assessed and quantified comparatively with what it exchanges for. It is however interesting to note that this system existed side by side the use of local and colonial currencies, which were actually in scare supply. The prevailing currencies in the pre and post colonial Efik include the following:

9.

mbámbá	-	cowry
ókpóhó	-	manila
bón	-	pound
sídíñ	-	shilling
béni	-	pence
áníní	-	a quarter pence
áfù	-	a half pence
tró	-	3 pence
sísì	-	6 pence
nái	-	9 pence
guine	-	1 pound, 1 shilling
naira	-	100 kobo
kobo	-	least unit of coin

Mbámbá 'cowry' and *ókpóhó* 'manila' were not minted currencies, but were used as traditional means of exchange for goods and services. Their uses date back to the

prehistoric era, when civilization and technological transfer were still evolving. Each object had the same value, and there were no lesser values like coins. An item (good or service) that was not up to the value of a whole cowry or manila was subjected to the barter economy. Before the coming of the colonial administrators, the currency counting system was synonymous with the numbering system of the language, where there was a direct correspondence between the value of the unit and the number that is counted. In post-colonial period when the value of pounds became higher than the newly introduced Naira, a Pound was exchanging for two naira and to the Efik people, two Naira was *bón kiét* ‘one Pound’ implying that every value of a Pound is doubled that of the Naira. This method of counting was prevailing even when the value of a Pound became equivalent to hundreds of Naira. The influence of the Pound is still prevalent in the Efik culture till today. The dowry paid on a bride on her traditional marriage is quantified in Pounds. 12 pound is the standard dowry, and is usually converted to the Nigerian Naira at the prevailing exchange rate. However, other monetary requirements of the marriage are settled with the Naira. When the amount involved is up to a hundred, *ékpát*, literally ‘a bag’ is used to measure the amount. For instance, *ékpát okuk kiet* (literally ‘one bag of money’) is a hundred Naira, *ékpát okuk duop* (literally ‘ten bags of money’) is a thousand Naira and so on. The concept of *ékpát* encodes the multiplication of the quantity involved by a hundred. It is noted that the old and passing generation are obsessed to this method of counting amounts. To the present generation, each amount is counted as the numeral value it represents. A naira is equivalent to 100 kobo, 5 naira is 500 kobo, 10 naira is 1000 kobo, 20 naira is 2000 kobo and 50 naira is 5000 kobo

4. Linguistic devices in Efik counting concepts

In the course of this research we discover that the system of counting in Efik interacts with a number of linguistic operations which are relevant for the derivation to take place. Some of these linguistic devices include nominalization, co-ordination, deletion, vowel harmony and vowel elusion among others. In the discussion that follows, we discuss each of these processes:

The only case of nominalization is found in the derivation of the number 9 as we can see in 10:

10. súk kiét	→	ú - súk kiét	(10 – 1)	‘nine’
(less one)		(? less one)		

The derived compound noun that yields nine is derived from the adverbial root in (a). Going by the lexical phonology rule, the adverbial root being the post-lexical component is introduced into the lexicon for nominalization through prefixation (Urua 2001). Observe that the initial input to the compound form in (b) is affected by tonal modification. The normalized prefix is introduced as having a specific definite referent, which is the number 10. Therefore, 9 is derived as *duóp úsúk kiét* ‘ten minus one’. This type of compounding process is known as Synthetic since it involves the creation of a compound noun from an adverb. Another type of compounding process

that is used as a counting device in Efik is endocentric, in which the one of the elements a head:

- 11(a) *íkié* - *íba* → (100x 2)
 hundred two
 'two hundred'
- (b) *íkié* - *ítión* → (100 x 5)
 hundred five
 'five hundred'
- (c) *íkié* - *dúóp* → (100 x 10)
 hundred ten
 'one thousand'

In 11 (a)-(c), *íkié* 'hundred' is the dominant constituent of the expressions syntactically. The non-head elements *íba* 'two', *ítión* 'five', and *dúóp* 'ten' respectively function as modifiers of the head. They specify the source of the derivation. However, this kind of derivation violates Williams (1981:48) Right-hand Head Rule (RHR) which says that '... in morphology, we define the head of a morphologically complex word to be the right-head member of that word'. This goes to show that this principle does not apply universally.

An important lexical device that is employed in the counting system of Efik is the use of co-ordinator *yé* 'and' to link figures or elements of the same syntactic equivalence, going by Carmie's (2006:53) claim that 'coordinate structure are constituents of the same syntactic category can be conjoined'. Allerton (1979:197) also maintains that ... the basic notion of co-ordination is one of parallel grouping of equals; no element is downgraded, all co-ordinated elements are on par with each other. The use of *yé* 'and' is very productive in number derivation. In all cases, it has a basic meaning of addition.

- 12 a) *edip yé dúóp* → (20 + 10)
 twenty and ten
 'thirty'
- (b) *edip yé ítión* → (20 + 5)
 twenty and five
 'twenty five'
- (c) *íkié yé dúóp* → (100 + 10)
 (hundred and ten)
 'one hundred and ten'

In 12, the conjunction *ye* ‘and’ is interpreted collectively since it has no unique lexical or content meaning. We agree with Camacho (1997:38) that its subcategorization requirements are minimal, which seems to suggest that the minimum feature content of *ye* ‘and’ is limited to proposition [+ prop]. In addition to its expressly additive meaning, this coordinator also triggers agreement and also matches case. We shall not delve into the details of this claim since it is not the focus of this paper.

Consonant deletion is another dominant device in the derivation of numbers in Efik. This usually involves the consonant of the coordinating element *ye* ‘and’:

13

- (a) *éfút yé kíét* → (15 + 1) *éfút ékíét* – ‘sixteen’
(fifteen and one)
- (b) *éfút yé íbá* → (15 + 2) *éfút étá* – ‘seventeen’
(fifteen and two)
- (c) *éfút yé ínáñ* → (15 + 4) *éfút énáñ* – ‘nineteen’
(fifteen and four)

In 13(a), the deletion of the consonant of the coordinator does not affect the following sound in the output of the derivation because it is a consonant. In (b) and (c), the deletion process further triggers vowel elision (since the following sounds are vowels), and the entire phenomenon is motivated by vowel harmony. While in (b), the initial vowel of the following form /i-/ is elided, in (c), the vowel of the coordinator and that of the following forms are elided and replaced with /a-/ due to assimilation of the vowel of the following forms. This is a case of harmony across word boundary; we can use a formal rule to represent this formalization:

14.
$$\begin{array}{c} [+ATR] \quad [-ATR] \\ V^1 \quad / \quad V^2 \quad - - - \\ \quad \quad \quad \swarrow \end{array}$$

This implies that it is the preceding vowel that copies the feature of the following vowel. V^1 is the target of the harmony and V^2 is the trigger of the harmony, where V/V are the vowels of the coordinator and the following form respectively. The arrow indicates the direction of the harmony, which is from right to left, hence progressive harmony.

We discovered that there are instance where the entire coordinator *ye* ‘and’ is deleted when its additive meaning changes to being multiplicative:

15

- (a) *íkíé íbá* → (100 x 2)
hundred two
‘two hundred’

(b) íkíé dúóp → (100 x 10)
hundred ten
'one thousand'

(c) íkíé édíp → (100 x 20)
hundred twenty
'two thousand'

The insertion of the coordinator *ye* between these pair of numeral element in 15 (a) – (c) will yield different counting results as we can see in 16:

16.

(a) íkíé yé íbá → (100 + 2)
hundred and two
'a hundred and two'

(b) íkíé yé dúóp → (100 + 10)
hundred and ten
'a hundred and ten'

(c) íkíé yé édíp → (100 + 20)
hundred and twenty
'a hundred and twenty'

The implication here is that complex numbers involving the co-ordinator 'yé' encodes additive meaning while those without it have multiplicative meaning.

Further instances of this can be seen in 17, where the harmony is not only progressive but complete:

17.

(a) ítíón yé íbá → ítíábá (5 + 2)
five and two
'seven'

(b) ítíón yé ítá → ítíátá (5 + 3)
five and three
'eight'

The numbers in 17 are derived as a result of the deletion of the consonant of the coordinator *ye* 'and'. The choice of the vowel of the co-ordinator is determined by the vowel of the following root form. The use of *ye* with its additive meaning can be iterative:

18.

- (a) édíp yé éfút yé ínáñ → édíp yé éfút énáñ (20 + 15 + 4)
 twenty and fifteen and four
 ‘thirty nine’
- (b) íkíé yé ata yé éfút yé íbá → íkie átá yé éfút ábá (100+ 60 + 15 + 2)
 hundred and sixty and fifteen and two
 ‘hundred and seventy seven’
- (c) íkíé édíp yé édíp yé éfút yé ítá → (100 x 20 + 20 + 15 + 3)
 hundred by twenty and twenty and fifteen and three
 ‘two thousand and thirty eight’ (íkíé édíp yé édíp yé éfút éta)

The iterative nature of *yé* ‘and’ makes the number system to exhibit the property of recursion, which can yield longer versions of complex numbers. This can be related to the nesting property of language which a descriptively adequate grammar should be able to account for.

In Efik, the free morpheme /ikv-/ is usually attached to a numeral to create a new word meaning ‘X times’.

19 numeral		underlying form	derived form	
(a) Ítíon	‘five’	Íkó itíon	íkótíon	‘five times’
(b) Ìbà	‘two’	Íká íbá	Íkáibá	‘two times’
(c) Ítá	‘three’	Íká ítá	Íkátá	‘three times’
(d) Ítiábá	‘seven’	Íká Ítiábá	Íkátíábá	‘seven times’

We have observed that when the /ikv-/ morpheme is attached to the numeral form, certain phonological processes are triggered. First, there is vowel assimilation between the terminating vowel of the prefix and the vowel of the second syllable root. Secondly, in the disyllabic stem in 6(a) – (c), as a result of prefixation, an underlying short vowel which occurs in the final position of /ikv-/ will be lengthened. The underlying final vowel of /ikv-/ in 6 retains its height when it is not attached to numeral roots, but when it occurs with the numerals, the terminating vowel of /ikv-/ becomes long, and no short vowel is found after a prefix. This is what Okrand (1984:125) calls “short vowel constraints”. It has also been observed that the initial vowel of the numeral is deleted by syncope rule.

5. Ordinal numerals

So far, we have limited our discussion on numbers and counting concepts in Efik to the cardinal numbers. Here, we investigate the processes of forming ordinal numbers in Efik. The ordinal number is used to indicate relative position of items in an ordered sequence in such a way that an order of referent is related to another. In English, ordinal numbers are derived from cardinal numbers by a method of attaching a suffix to the latter. In Efik, however, there are only two ordinal numbers found in the

lexicon; *ákpá* ‘first’ and *ákpátrê* ‘last’. *Údiáná* ‘second’ is derived from the verb *díán* ‘add’, which is extended by a derivational suffix and realized through nominalization by prefixation. The others are formed by the addition of the ordinal indicator *óyóhó* to the cardinal number:

20

- | | | |
|-----------------------|---|-------------|
| (a) <i>óyóhó ítá</i> | - | ‘third’ |
| (b) <i>óyóhó ínáñ</i> | - | ‘fourth’ |
| (c) <i>óyóhó dúóp</i> | - | ‘tenth’ |
| (d) <i>óyóhó édíp</i> | - | ‘twentieth’ |

Oyóhó here can be understood as the ‘order of sequence’, which equals English ordinal suffix, *-th*. The major difference between the morphological structure of ordinal and cardinal numbers is that cardinal numbers cannot take plural markers, which the ordinal numbers can:

21

- | | | |
|---------------------------|---|------------------|
| (a) <i>mme óyóhó ítá</i> | - | ‘third (pl)’ |
| (b) <i>mme óyóhó ínáñ</i> | - | ‘fourth (pl)’ |
| (c) <i>mme óyóhó dúóp</i> | - | ‘tenth (pl)’ |
| (d) <i>mme óyóhó édíp</i> | - | ‘twentieth (pl)’ |

22

- | | | |
|----------------------|---|---------------|
| (a) <i>*mmé ítá</i> | - | ‘three (pl)’ |
| (b) <i>*mmé ínáñ</i> | - | ‘four (pl)’ |
| (c) <i>*mmé dúóp</i> | - | ‘ten (pl)’ |
| (d) <i>*mmé édíp</i> | - | ‘twenty (pl)’ |

From the Efik data, we can see that ordinal numbers express not just positions within a sequence, that determine regularity, frequency or size, which themselves can be marked for number, whereas the cardinal number basically indicates quantity. Although in English, the reverse is the case where cardinal numbers take plural forms as in twos, threes, fours, tens, twenties and so on and where the ordinal number cannot take plural inflection.

6. Syntactic Representations

In this section, we examine aspects of the syntax of numerals in Efik. The two categories of number; cardinal numbers and ordinal numbers occur as modifiers of nouns within the overall noun phrases. According to Dryer (2005), the cardinal number indicates how many referent the NP denotes, while the ordinal numbers specify a referent in terms of its order with respect to other referents. The two number categories exhibit different syntactic behaviour within the NP structures in Efik. The cardinal number follows the head noun, while the ordinal number precedes it:

23

- (a) *íbán* *íba*
 women-PL two
 ‘two women’

- (b) *údiána* *ánwàn*
 second-DEF woman-SG-DEF
 ‘(the) second woman’

In 23(a), the cardinal number *íba* ‘two’ post modifies the noun *íbán* ‘women’ and there is agreement in number. However, if the discourse participants have background knowledge of the noun, the numeral modifier can stand on its own to convey sense, leaving the unexpressed noun in the context of conversational experience. In this way, number can be conceptualized pragmatically in Efik. In (b), the ordinal number *údiána* ‘second’ premodifies the noun *nwàn* ‘woman’, which agrees mutually in definiteness.

Cardinal numerals in Efik can function as determiners in expressing indefiniteness. Mensah (in prep) maintains that the most common lexical device used in expressing indefiniteness is the numeral *kiét* ‘one’, which can inflect for number and case:

24

- (a) *ówó* *kiét*
 person-SG-ACC INDEF
 ‘a/one person’

- (b) *ákpákáhá* *kiét*
 chair-SG-ACC INDEF
 ‘a/one chair’

The use of the determiner *kiét* ‘one’ is generic and indicates that the noun which it modifies is not known to the discourse participants. The use of this numeral determiner triggers accusative case, (which is not marked by inflection in Efik) on the noun irrespective of the syntactic structure of the phrase.

When ordinal numerals occur within a NP, we observed the phenomenon of tone dropping, which affects the noun they modify:

- 25(a) *étó*
 tree
 ‘(a) tree’

- 26(a) *èkpàt*
 bag
 ‘(a) bag’

- (b) *ákpá étò*
 NUM tree-SG
 ‘(the) first tree’

- (b) *údiána ékpàt*
 NUM bag-SG
 ‘(the) second bag’

In 25(b) and 26(b), the tone of the head noun is totally dependent on the tone of its numeral modifiers, where a HH and LL structures have dropped to become HL. In other words, the sequence of modifier and noun require the noun to drop its tone before its modifier. It is only numerals and adjectives that can affect the morpho-syntactic structure of NPs in this way in Efik. This evidence shows that the behaviour of tones is equally significant to the structure of NP in addition to linear order of elements. Another morphosyntactic property of numeral in Efik is that both cardinal and ordinal numbers can be used as pronouns and adjectives respectively in the language:

27

(a) N- dí ówó kíét á- má -dé ndító
 1SG be person NUM 3SG love PRES children
 'I am someone that loves children'

(b) M- ké- mén ákpá ítié ké úfòk-ńwèd
 1SG PAST take NUM place PREP school
 'I took first position in school'

The cardinal numeral in 27(a), *kíét* 'one', which modifies the noun *ówó* 'person' functions as the indefinite pronoun someone or somebody in English. This is however possible only if the referent of the noun denotes a singular person. In (b), the ordinal numeral *ákpá* 'first' modifies the noun *ítié* 'position', which has a prepositional complement.

7. Concluding remarks

In this paper, we argue in line with Nelson and Toivonen (2000:188) that once the set of rules for forming numeral has been acquired, a speaker of a language is able to compute and generate an unlimited number of numerals, contrary to Olderoge's (1984) claim that Efik does not have a system of forming complex numerals beyond a thousand. We have identified the basic units of numbers as the lexical numerals from which complex numerals are derived. We discovered that the system of numeration can trigger significant linguistic processes such as nominalization, insertion, elision, weakening as well as being sensitive to syntactic representations, especially as modifiers within the noun phrase. Our assumption is that the need to understand and work with numbers is fast becoming increasingly compelling in our contemporary society given the challenges posed by the revolution in information and communication technology, therefore every culture's system of numeration ought to trigger off significant research interest.

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The Counting System in Ikwere*

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Traditionally, Ikwere records a vigesimal counting system, which is irregular, complex and restricted. This paper, therefore, provides a detailed description of such inconsistency observed in the different ways of counting in the language as the normal counting, counting of money and materials. The paper also notes that the highest numeral in the traditional counting system is 400, thus, any counting above 400 required the manipulation of complex mathematical processes of addition and multiplication. As a result of these difficulties, most speakers of Ikwere rarely count in the language. The paper further notes the existence of the modern (decimal) system of counting, which is yet to absolutely replace the traditional counting. It evolved with the aim of unifying the different ways of counting; simplifying the difficulties encountered in the traditional system; broadening the scope to cope with modern technologies, and expressing greater number of higher numerals. It is believed that the present paper will contribute to the documentation of different ways of counting in the language.

1. Introduction

Ikwere is an Igbooid language of the West Benue-Congo family of Niger-Congo Phylum of languages (Williamson and Blench 2000:31). It consists of twenty-four divergent dialects spoken in four Local Government Areas (Ikwere, Emohua, Obio/Akpo and part of Port Harcourt) of Rivers State of Nigeria. The language records both the traditional and the modern counting system.

As in most African languages, counting in the Ikwere language is a rare phenomenon among the younger generation of the native speakers. It is, however, common with fewer members of the Ikwere community. Similar to the situation Atóyèbí (2006:63) observes in Òkò, most Ikwere speakers often shy away from counting in the language because they are not certain of the correct rendering of most of the numerals. This suggests that the numeral system is an endangered area in the language. This scenario should be of serious concern to any one who considers the survival of languages important. In order to save this terrible situation, this paper not only serves as a documentation of numerals in Ikwere, it also reveals the problem areas of counting in the language and suggests the solution that could prevent it from becoming extinct. We, therefore, present the traditional and the modern counting system.

2. The Traditional System

The traditional counting system in Ikwere is vigesimal, which means that the counting is 20 – based. The significant landmarks for this counting system are ótù/ń̀ń̀m ‘one’, ó̀gwnú/ó̀gnú ‘twenty’ and ń̀nù ‘four hundred’. In addition to the

preceding landmarks numbering, which consist of simple forms, the cardinal numbering from two to ten also consist of simple forms. The numbering from eleven to nineteen is additive. Here, the numeral '10' functions as the base to which lesser units such as the numerals 1 – 9 are added. Thus, this stage of numerals consists of compounds derived through the mathematical process of addition. The next stage of numerals ranges from twenty (20) through three hundred and ninety – nine (399) before four hundred (400). It has the numeral '20' functioning as the base, to which lesser numerals are added. This stage of counting, which consists of either a compound form or a complex form is derived through the mathematical processes of addition or a combination of addition and multiplication, respectively. From the significant landmarks noted above, it is obvious that the highest simple place value of the traditional system is *nn̄* 'four hundred'. It is interesting to note that the traditional counting system of most African languages like Igbo, Kana and Echie as pointed out by Emenanjo (1978:54), Ikoro (1996:85) and Ndimele (2003:119), respectively, have the highest unit of counting as 400. This implies that any counting above four hundred involves a greater complexity of mathematical manipulation of smaller numbers through the processes of addition and multiplication. We present a list of the traditional numerals in Ikwere with data from the Qmuanwa variety of the language in table 1. We, however, list some of the forms of other varieties like Igwuruta and the southern dialects where necessary.

Table 1: *Traditional numerals in Ikwere*

1	ótù (<i>ń̀n̄m̄</i>)		one
2	wáàb̄ (<i>èb̄ / àb̄</i>)		two
3	wá ¹ át̄ (<i>èt̄ / àt̄</i>)		three
4	wá ¹ án̄ (<i>èn̄ / án̄</i>)		four
5	wí ¹ isn̄ (<i>isn̄</i>)		five
6	wí ¹ isn̄n̄ (<i>isn̄n̄</i>)		six
7	wá ¹ às̄ (<i>ès̄ / às̄</i>)		seven
8	wá ¹ ás̄ ¹ t̄ (<i>às̄¹t̄</i>)		eight
9	wí ¹ ít̄ ¹ lú (<i>ít̄¹lú</i>)		nine
10	nr̄ (<i>ir̄</i>)		ten
11	nr̄ n̄ ótù (<i>ń̀n̄m̄</i>)	[10 + 1]	eleven
12	nr̄ n̄ àb̄	[10 + 2]	twelve
13	nr̄ n̄ àt̄	[10 + 3]	thirteen
14	nr̄ n̄ án̄	[10 + 4]	fourteen
15	nr̄ n̄ isn̄	[10 + 5]	fifteen
16	nr̄ n̄ isn̄n̄	[10 + 6]	sixteen
17	nr̄ n̄ às̄	[10 + 7]	seventeen

18	h́ŕ nĩ àsá ⁴ tọ	[10 +8]	eighteen
19	h́ŕ nĩ ńto ⁴ lú	[10 +9]	nineteen
20	ọ ⁴ gnú (ọ ⁴ gwnú)		twenty
21	ọ ⁴ gnú nĩ ọtù (ń ⁴ nĩm)	[20 +1]	twenty-one
22	ọ ⁴ gnú nĩ àbọ	[20 +2]	twenty-two
28	ọ ⁴ gnú nĩ àsá ⁴ tọ	[20 +8]	twenty-eight
29	ọ ⁴ gnú nĩ ńto ⁴ lú	[20 +9]	twenty-nine
30	ọ ⁴ gnú nĩ h́ŕ	[20 +10]	thirty
31	ọ ⁴ gnú nĩ h́ŕ nĩ ọtù	[20 +10 +1]	thirty-one
37	ọ ⁴ gnú nĩ h́ŕ nĩ wá ⁴ àsà	[20 +10 +7]	thirty-seven
40	ọ ⁴ gnú àbọ(láà/lâwùrù)	[20 x 2]	forty
41	ọ ⁴ gnú àbọ nĩ wáàbọ	[20 x 2 + 2]	forty-one
50	ọ ⁴ gnú àbọ nĩ h́ŕ	[20 x 2 +10]	fifty
52	ọ ⁴ gnú àbọ nĩ wáàbọ	[20 x2 + 3]	fifty-two
60	ọ ⁴ gnú àtọ	[20 x 3]	sixty
61	ọ ⁴ gnú àtọ nĩ ọtù	[20 x 3 + 1]	sixty-one
70	ọ ⁴ gnú àtọ nĩ h́ŕ	[20 x 3 + 10]	seventy
71	ọ ⁴ gnú àtọ nĩ h́ŕ nĩ ọtù	[20 x 3 + 10 + 1]	seventy-one
80	ọ ⁴ gnú ànọ	[20 x 4]	eighty
81	ọ ⁴ gnú ànọ nĩ ọtù	[20 x 4 + 1]	eighty-one
90	ọ ⁴ gnú ànọ nĩ h́ŕ	[20 x 4 +10]	ninety
91	ọ ⁴ gnú ànọ nĩ h́ŕ nĩ ọtù	[20 x 4 +10 + 1]	ninety-one
100	ọ ⁴ gnú ńsnê	[20 x 5]	hundred
101	ọ ⁴ gnú ńsnê nĩ ọtù	[20 x 5 + 1]	hundred and one
111	ọ ⁴ gnú ńsnê nĩ h́ŕ nĩ ọtù	[20 x 5 +10 + 1]	hundred and eleven
120	ọ ⁴ gnú ńsnúnù	[20 x 6]	hundred and twenty
130	ọ ⁴ gnú ńsnúnù nĩ h́ŕ	[20 x 6 +10]	hundred and thirty
140	ọ ⁴ gnú àsà	[20 x 7]	hundred and forty
150	ọ ⁴ gnú àsà nĩ h́ŕ	[20 x 7 + 10]	hundred and fifty
160	ọ ⁴ gnú àsá ⁴ tọ	[20 x 8]	hundred and sixty
170	ọ ⁴ gnú àsá ⁴ tọ nĩ h́ŕ	[20 x 8 +10]	hundred andseventy
180	ọ ⁴ gnú ńto ⁴ lú	[20 x 9]	hundred and eighty
190	ọ ⁴ gnú ńto ⁴ lú nĩ h́ŕ	[20 x 9 + 10]	hundred and ninety
200	h́ŕ ọ ⁴ gnú	[20 x 10]	two hundred
210	h́ŕ ọ ⁴ gnú nĩ h́ŕ	[20 x 10 + 10]	two hundred and ten
300	h́ŕ ọ ⁴ gnú nĩ ọ ⁴ gnú ńsnê	[20 x 10 + 20 x 5]	three hundred
400	ínù		four hundred

The foregoing list demonstrates that the compound forms of the numerals are linked with the additive morpheme nĩ /nĩ~ nù /nù ‘and’ depending on the dialect,

whereas those denoting multiplication process involve a sequence of the higher and lower units without an intervening morpheme. The alternative forms of the additive morpheme are subject in harmony to the vowel of the following numeral. In fast speech, however, the vowel of the additive morpheme *nĩ /nĩ~ nù /nù* ‘and’ completely assimilates to the vowel prefix of the following numeral. The result of this assimilation is identical vowel length without tonal modification. We show example in 1-2

1. *nrí nò = ótù* ‘Eleven’
(ten conj one)

2 *nrí nà = àbõ* ‘Twelve’
(ten conj two)

In Omuanwa dialect and some varieties of the Ikwere(northern) language, the numerals 2 -9 are reprefix with *wV-* added to the form listed in parenthesis in some other varieties. We note, however, that the forms prevalent in some other varieties like Igwuruta, Aluu, etc. are used interchangeably with the reprefix form in Omuanwa. This is done particularly, when the numerals 2 -9 are combined with a base, of a higher unit as additive. When, however, they are combined with the base as multiplicative, the form in parenthesis in table 1 is the choice in Omuanwa counting. In other words, the form in parenthesis is never interchanged with the reprefix form. We demonstrate examples in table 2.

Table 2: *Counting with (out) Reprefix Form*

12 = <i>nrí nĩ àbõ</i>	<i>nrí nĩ wáàbõ</i>	[10 +2]
13 = <i>nrí nĩ àtõ</i>	<i>nrí nĩ wá¹átõ</i>	[10 +3]
14 = <i>nrí nĩ ànõ</i>	<i>nrí nĩ wá¹ánõ</i>	[10 +4]
15 = <i>nrí nĩ ìsnê</i>	<i>nrí nĩ wí¹ísne</i>	[10 +5]
16 = <i>nrí nĩ ìsnúnù</i>	<i>nrí nĩ wí¹ísnúnù</i>	[10 +6]
17 = <i>nrí nĩ àsâ</i>	<i>nrí nĩ wá¹àsâ</i>	[10 +7]
18 = <i>nrí nĩ àsá¹tõ</i>	<i>nrí nĩ wá¹ásá¹tõ</i>	[10 +8]
19 = <i>nrí nĩ ìto¹lú</i>	<i>nrí nĩ wí¹ító¹lú</i>	[10 +9]
40 = <i>õ¹gnú àbõ</i>		[20 x 2]
60 = <i>õ¹gnú àtõ</i>		[20 x 3]
80 = <i>õ¹gnú ànõ</i>		[20 x 4]
100 = <i>õ¹gnú ìsnê</i>		[20 x 5]

Apart from the fact that the reprefix form can be used interchangeably with the form found in some other varieties, the numerals from two to nine can further be counted in slightly different forms in Omuanwa. We list them in table 3.

Table 3: *Reduced form of Ikwere Numerals*

2	m̃bǒ	two
3	tǒ	three
4	ñnǒ	four
5	sné	five
6	snúnù	six
7	sâ	seven
8	sá ⁴ tǒ	eight
9	tó ⁴ lú	nine

Table 3 demonstrates that the wV- prefix attached to the numerals 3 – 9 is deleted alongside with the V- prefix dominant in some other varieties of the language. In other words, we observe a successive syllable reduction in this form of counting, which suggests the shape these numerals may assume in future. We further observe tonal modification in some of the numerals. For instance, the falling tones in the final syllable of *isnê* ‘five’ and *anǒ* ‘four’ are simplified to high and low tone as in *sné* and *ñnǒ*, respectively. We also note the phonological process of strengthening when the vowel [a] becomes a nasal, which is homorganic to the following consonant as in *abǒ* ‘two’ and *anǒ* ‘four’ changing to *m̃bǒ* and *ñnǒ*, respectively. It is worthy of note that this form of counting is mostly prevalent with children who use it as some sort of nursery rhymes.

2.1 Different ways of counting in Ikwere

Despite the fact that the traditional counting in Ikwere is complex and limited in scope as observed in table 1, it is also irregular. There is no uniform and straight forward way of counting certain items in the language. They require some degree of manipulations that are not directly connected with the normal way of counting in the language. Some of the items that their counting somehow deviates from the normal counting include money, yams, farmland, etc.

2.1.1 Counting of money

Most communities in Ikwere call the ‘money’, *ɪwáí*, while others call it *áwáí* or *é⁴gnó* or *abǐ*. The process of counting money in Ikwere has been influenced by the type of currency available to the people at a particular time. After the use of manila, which in Ikwere is called *abǐ*, the currency to which Ikwere people were introduced with the colonization of Nigeria by the British was pound. The pound, which is known by the Ikwere speakers as *pôm/pâm* depending on the dialect, was replaced after Nigeria’s independence with the one printed in Nigeria. It is important to note that even though Nigeria was responsible for the printing of this currency, it was still in line with the British pound. The Nigerian pound, however,

lasted till early 1970s when it was replaced with the Nigeria's currency Naira (N) and kobo (K). The currency, Naira and kobo, which is presently in use in the country is decimalized. Table 4 demonstrates examples of counting of money in Ikwere.

Table 4: *Counting of Money in Naira and kobo*

1k	ó ⁺ tú kòbò
2k	kòbò àbò
3k	kòbò àtò
4k	kòbò ànò
5k	kòbò ìsnê
6k	kòbò ìsnúnù
7k	kòbò àsâ
8k	kòbò àsá ⁺ tò
9k	kòbò ìto ⁺ lú
10k	hírí kòbò
20k	ògnú kòbò
100k/N1	ògnú kòbò ìsnê/ó ⁺ tú nàírá
N2	nàírá àbò(láà/lâwùrù)
N10	hírí nàírá
N20	ògnú nàírá
N30	ògnú nàírá nì hí
N40	ògnú nàírá àbò
N50	ògnú nàírá àbò nì hí
N100	ògnú nàírá ìsnê
N200	ó ⁺ tú àkpà nàírá
N500	àkpà nàírá àbò nì ògnú nàírá ìsnê
N900	àkpà nàírá ànò nì ògnú nàírá ìsnê
N1000	àkpà nàírá ìsnê
N1500	àkpà nàírá àsâ nì ògnú nàírá ìsnê
N2, 000	hírí àkpà nàírá
N10,000	ògnú àkpà nàírá àbò nì hí àkpà nàírá

In addition to modifying the counting of money with either nàírá or kòbò as appropriate, counting of money in the language differ from the normal counting in the use of the term **àkpà** 'bag'. This is because the Ikwere people count any amount of money from two hundred naira and above in bags. Thus, instead of counting two hundred naira as **hírí ó⁺gnú nàírá**, it is counted as **ó⁺tú àkpà**. If, however, the counting is done in pounds, then hundred pounds is regarded as **ó⁺tú**

àkpà. The origin of using two hundred as a base for counting money in bags dates back to the transition period of replacing pounds with naira as Nigeria's new currency. This is because the value of one hundred pounds then was equivalent to two hundred naira. Thus, till date counting of money in Ikwere still follows the traditional system of counting and differs slightly from the normal counting. Weje (1999:29), however, records one hundred naira and two hundred naira as ó⁺tú àkpà and àkpà nàírá láà, respectively. We believe she may be mistaking counting in naira with pounds.

2.1.2 Counting of materials

This section treats items that are not money as materials. Thus, we examine items that are counted in different ways in Ikwere here.

2.1.2.1 Counting of yams

Ikwere also records different ways of counting materials like yams or oil palm fruits. As in the counting of money, the counting of materials such as yam or oil palm fruit deviates from normal counting from the numerals, two hundred (200) and above. See examples in Omuanwa dialect of Ikwere in table 5.

Table 5: *Counting of tubers of yam in Ikwere*

100 tubers	ógnú jí ìsnê
200 tubers	ó ⁺ tú írí jí
300 tubers	ó ⁺ tú írí jí nǐ ógnú jí ìsnê
400 tubers	ó ⁺ tú ínnù jí
500 tubers	ó ⁺ tú ínnù jí nǐ ógnú jí ìsnê
900 tubers	ínnù jí àbǒ nǐ ógnú jí ìsnê
1000 tubers	ínnù jí àbǒ nǐ ó ⁺ tú írí jí
12000 tubers	ínnù jí àtǒ
1, 500 tubers	ínnù jí àtǒ nǐ ó ⁺ tú írí jí nǐ ógnú jí ìsnê
2, 000 tubers	ínnù jí ìsnê

Table 5 shows that two hundred tubers of yam or bunches of oil palm fruit are expressed with ó⁺tú írí instead of ó⁺tú àkpà as in the counting of money or òrí ó⁺gnú of traditional counting. The differences we have observed so far reflect the inconsistency and complexity one encounters when counting in Ikwere. No wonder speakers shy away from counting in the language as it requires some degree of mastery of counting of different items.

2.1.2.2 Counting of farm ridges

The occupation of the Ikwere people is mainly farming but with the acquisition of western education by a greater percentage of the adult population of the working

group, it shifted to jobs in public service, for instance. Yam cultivation is one of the major crops planted in Ikwere. Thus, farm ridges are arranged in such a way as to accommodate the planting of yams. It, therefore, follows that counting of farm ridges is done differently from normal counting in Ikwere (Omuanwa particularly). Rather than count the ridges directly, the number of divisions of a particular farmland area of an individual farm is considered along side with the various path ways through which one can move round the farm. Each of the divisions is called **m̀kp̀òbí** or **ùhnèb̀ĩrĩ** ‘cross or horizontal pathway’. This pathway is wider and longer than any other pathway in the farm. The distance between one horizontal pathway to another is called **m̀kp̀ĩk̀ĩrĩ**. The size of the **m̀kp̀ĩrĩ** or **úmé-úbĩ** ‘ridge’ is further determined by the number of vertical pathways known as **ágbù-úzò** on the farm land. It is interesting to note that the number of ridges in an individual farm land is not counted directly but it is based on the number of both the horizontal and vertical pathways on that farm. The term **m̀kp̀ĩrĩ** is used to depict the ridge in terms of length, while the term **úmé-úbĩ** portrays the idea of the width of the ridge. We demonstrate examples in 3 – 5 in Omuanwa.

3. ó⁴tu ágbù-úzò nĩ m̀kp̀òbí àbõ
(one Vert.-path conj. Hori. two)
‘One vertical path with two divisions’ means (*Six ridges*)
4. ágbù-úzò àbõ m̀kp̀òbí àtò
(Vert-path two Hori-path three)
‘Two vertical path with three divisions’ means (*Nine ridges*)
5. ágbù-úzò àtò m̀kp̀òbí ànò
(Vert-path three Hori. path four)
‘Three vertical parts with four divisions’ means (*Twelve ridges*)

The foregoing shows that there is no one to one correspondence between the expressions and the number of ridges intended. One needs to be acquainted with the system of counting of ridges in the area before one can deduce the number. This is further proof of the complexity of the traditional counting system.

2.1.2.3 Counting of cloths (wrapper)

Counting of pieces of cloth, particularly the ones women tie in their waist also differs from other types of counting. Rather than measure wrapper in yardage as in English, Ikwere measures and counts in waist. One waist, that is, **ó⁴tú íknù** is equivalent to two yards in English, while **íknù àbõ** ‘two waist’ is equivalent to four yards. Consider examples 6-9 in Omuanwa.

6. ó ¹ tú íknù (one waist)	‘One wrapper’ Two yards of cloth’
7. íknù àbõ (waist two)	‘Two wrappers’/‘four yards’
8. íknù àtõ (ó ¹ tú míkpà̀̀kpà) (waist three)	‘three wrappers’/‘six yards’
9. íknù ànõ (ó ¹ tú míkpà̀̀kpà) (waist four)	‘eight yards’

Examples 8 and 9 show that ó¹tú míkpà̀̀kpà is equivalent to either six or eight yards of wrapper. This further reflects the complexity of ambiguity characteristic of traditional counting. Native speakers who are conversant with this type of counting, however, know that ó¹tú míkpà̀̀kpà of six yards refers to block prints, while that of eight yards refers to george wrappers. Thus, a definition or modification of the type of material intended is required to know whether it is six or eight yards. The use of the term ó¹tú míkpà̀̀kpà indicates the idea of wholeness. This means that an individual can use it for two wrappers and a blouse or head tie depending on one’s choice.

2. 1.2.4 Adult and Youth Counting

Despite the differences observed in the counting system of Ikwere based on different items, the age of speakers also contribute to the existing variation in the system. While the older people employ subtraction method, the younger generations of speakers count straight on without any form of manipulation. Thus, the adults especially from forty years and above count by subtracting a lesser unit from base 10 or 20 and multiples of 20, while the youth count normally. See examples from 10- 12 in Igwuruta.

10 ìsné pùrù nù ògnú (five out conj twenty)	‘fifteen’
11 àtõ pùrù nù ògnú ìsné (three out conj twenty five)	‘ninety seven’
12 òrí pùrù ògnú láà (ten out twenty two)	‘thirty’

3. The Modern Counting System

From the preceding analysis of the traditional counting in Ikwere, it is obvious that the processes involved in the system are cumbersome, full of irregularities, and limited in scope. No wonder native speakers who are exposed to the western counting system, especially, English are swift to abandon counting in Ikwere for the simpler one. Even most of the older speakers, who are expected to use the numerals comfortably are often uncertain as to which is which. In an attempt to resolve these difficulties and cope with the requirements of modern technology, the Ikwere Language Committee in 1997 published *Counting in Ikwere (in decimal system)*, which is a modification of the traditional counting system.

The modern counting, therefore, evolved in order to simplify as much as possible the difficulties encountered in the system; broaden the scope to and make it easier to translate from English to Ikwere and vice versa (Emenanjo 1978 and Weje 1999). The modern counting system is a shift from the vigesimal 20-based counting to the decimal 10 –based counting system. Following Ekwulo (2001:26), we list the significant landmarks of modern counting in table 6.

Table 6: *Ikwere modern counting landmarks*

0	ètèkné(èwhùèwhù)	zero
1	ótù (ń̀ń̀m)	one
10	ń̀rí (ĩrí)	ten
100	ó̀tú ríwhù (ríwhù ń̀ń̀m)	one hundred
1000	ó̀tú pókwú (pókwú ń̀ń̀m)	one thousand
1,000,000	ó̀tú ñ̀dásĩ (ñ̀dásĩ ń̀ń̀m)	one million
1,000,000,000	ó̀tú ñ̀dè (ñ̀dè ń̀ń̀m)	one billion
1,000,000,000,000	ó̀tú pókwú ñ̀dè (pókwú ñ̀dè ń̀ń̀m)	one trillion

The difference between the traditional counting and the modern counting is from the numeral twenty (20) and above. The numerals from 1-19 is identical in both traditional and the modern counting. As we noted earlier, the modern numerals are based in tens. Consider examples in table 7

Table 7: *The modern counting in Ikwere*

0	ètèkné(èwhùèwhù)	zero
1	ótù (ń̀ń̀m)	one
2	wáàbõ (èbõ /àbõ)	two
3	wá̀átõ (ètõ/ àtõ)	three
4	wá̀ánõ (èñõ/ ánõ)	four
5	wí̀ísne (ísne)	five
6	wí̀ísnú (ísnú)	six

7	wá ¹ àsâ (è ¹ sâ/ àsâ)		seven
8	wá ¹ ásá ¹ tó (àsá ¹ tó)		eight
9	wí ¹ ító ¹ lú (ító ¹ lú)		nine
10	hírí (írí)		ten
11	hírí nǐ ótù (ń ¹ ním)	[10 + 1]	eleven
12	hírí nǐ àbọ	[10 +2]	twelve
13	hírí nǐ àtọ	[10 +3]	thirteen
14	hírí nǐ ànọ	[10 +4]	fourteen
15	hírí nǐ ìsnê	[10 +5]	fifteen
16	hírí nǐ ìsnúnù	[10 +6]	sixteen
17	hírí nǐ àsâ	[10 +7]	seventeen
18	hírí nǐ àsá ¹ tó	[10 +8]	eighteen
19	hírí nǐ ìto ¹ lú	[10 +9]	nineteen
20	hírí àbọ	[10 x 2]	twenty
21	hírí àbọ nǐ ótù	[10 x 2 + 1]	twenty-one
30	hírí àtọ	[10 x 3]	thirty
35	hírí àtọ nǐ ìsnê	[10 x 3 + 5]	thirty-five
40	hírí ànọ	[10 x 4]	forty
41	hírí ànọ nǐ ótù	[10 x 4 + 1]	forty-one
50	hírí ìsnê	[10 x 5]	fifty
60	hírí ìsnúnù	[10 x 6]	sixty
70	hírí àsâ	[10 x 7]	seventy
80	hírí àsá ¹ tó	[10 x 8]	eighty
90	hírí ìto ¹ lú	[10 x 9]	ninety
100	ó ¹ tú ríwhù		hundred
101	ó ¹ tú ríwhù nǐ ótù	[100 + 1]	hundred and one
112	ó ¹ tú ríwhù nǐ hírí nǐ àbọ	[100+10+2]	hundred and twelve
120	ó ¹ tú ríwhù nǐ hírí àbọ	[100 + 10 x 2]	hundred and twenty
130	ó ¹ tú ríwhù nǐ hírí àtọ	[100 +10 x 3]	hundred and thirty
150	ó ¹ tú ríwhù nǐ hírí ìsnê	[100 +10 x 5]	hundred and fifty
200	ríwhù àbọ	[100 x 2]	two hundred
300	ríwhù àtọ	[100 x 3]	three hundred
400	ríwhù ànọ	[100 x 4]	four hundred
500	ríwhù ìsnê	[100 x 5]	five hundred
600	ríwhù ìsnúnù	[100 x 6]	six hundred
700	ríwhù àsâ	[100 x 7]	seven hundred
800	ríwhù àsá ¹ tó	[100 x 8]	eight hundred
900	ríwhù ìto ¹ lú	[100 x 9]	nine hundred
950	ríwhù ìto ¹ lú nǐ hírí ìsnê	[100 x 9+10 x 5]	nine hundred and fifty
1,000	ó ¹ tú pókúwú		one thousand

2,000 pók-wú àbḡ	[1,000 x 2]	two thousand
5,000 pók-wú ʼisnê	[1,000 x 5]	five thousand, etc.

Tables 1 and 6 show that the additive and the multiplicative processes are involved in the two systems. As in the traditional counting, an additive morpheme is used to link the lesser unit of numerals to the higher ones, whereas the sequences of numerals denoting multiplicative process are left bare.

A cursory look at both the traditional and the modern system of counting reveals a lot of improvement of the former by the latter. We note, however, that the traditional counting is the choice for most speakers whenever counting is done in Ikwere. Speakers are yet to be acquainted with the modern counting as well as the different landmarks. Thus, an awareness programme is needed urgently to bring the existence of a simpler counting system to the knowledge of the speakers and to get them to count in the language.

4. Ordinals

So far the preceding sections in this paper reflect Ikwere cardinals. The present section, however, focuses on the ordinals of the language. Ordinals are realized by prefixing the morpheme *kè* to the cardinal number. Consider examples 13- 18 in Omuaniwa and Igwuruta.

<i>Omu</i>	<i>anwa</i>	<i>Igwuruta</i>	
13.	kè mbòm	kè mbò	‘first’
14.	kè wáàbò	kè àbò	‘second’
15.	kè wí [↓] ító [↓] lú	kè ìtó [↓] lú	‘ninth’

5. Conclusion

This paper is of the view that speakers of Ikwere are more aware of the traditional vigesimal counting system than the modern decimal system and often shy away from counting in the language. This results from the fact that the traditional system is complex, irregular and limited in scope to cope with modern technology. The situation could, however, be controlled with the development of the modern decimal counting system, which evolved to grapple with such difficulties. The challenge for language enthusiast is, therefore, how to successfully create awareness of the existence of the new counting system and to get speakers count in the language. Otherwise, this area of the language is bound to go extinct.

Note

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Sources of Complexity in the Yorùbá Numeral System

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A lot of research into the counting system of the Yoruba language has focussed on how to simplify the system. This paper attempts to describe the Yoruba counting system by relying on its internal logic, and explain, not merely identify, the sources of complexity. The complexity of numeral derivation in Yoruba is due to many factors. Higher numbers are compounded from the cardinal forms and the process of compounding involves series of mathematical operations. The products of these operations are then subjected to complex phonological processes which produce forms that are sometimes radically different from their constituent bases. Yoruba also has a multiplicity of number scales (or ‘bases’) and employs some ‘irregular’, non-analytic numbers. Finally, in higher numerals, place value changes are sometimes unpredictable.

Keywords: complex, decimal, Hindu-Arabic, number system, numeration, place value, revision, traditional, vigesimal, Yorùbá.

1. Introduction

A lot of research into the Yoruba numerals has focussed on how to reduce the complexity of the system. These works include Armstrong (1962), Oyelaran (1980), Fakinlede (2003), and Awobuluyi (2008). Olubode-Sawe (2010a) also suggests some methods of popularizing a new number system after it has been standardized. Decimalization is the focus of these proposals which have been reviewed in Olubode-Sawe (2010b). The sources of complexity are sometimes mentioned but not usually explicated.

Armstrong (1962) considers Yoruba numerals ‘a fascinating chapter in the history of mathematics and the development of human thought.’ Bamgbose (1986:36) also refers to ‘the problem’ of Yoruba numerals while Awobuluyi (1994: 33) mentions the ‘very cumbersome and complicated manner’ of deriving them. David-Osuagwu (2009), introducing number base in a primary school text, describes the Yoruba counting system as ‘even more complex’ than counting systems in some other African languages because it includes multiplication and subtraction. This paper attempts to describe the Yoruba counting system by relying on its internal logic, not by how it differs from the Hindu-Arabic system, and identifies the sources of complexity. The data on Yoruba traditional numeration used here is generated from Abraham (1958).

Yoruba has four sets of whole numbers. There is a cardinal series; a long ‘counting series’ devised for counting cowries; an ‘adjectival series’; and an ordinal series as shown in Table 1 below:

Table 1: The Four Sets of Yoruba Numbers

	<i>cardinal</i>	<i>long</i>	<i>adjectival</i>	<i>ordinal</i>
1	òkàn	oókan/ení	kan	ìkínní
2	Èjì	eéjì	méjì	ìkẹjì
10	ẹwá	ẹẹwàá	mẹwàá	ìkẹwàá

14	ẹ̀rínlá	ẹ́ẹ̀rínlǎá	mẹ̀rínlǎ	ìkẹ̀rínlǎ
19	òkàndínlógún	oókàndínlógún	mòkàndínlógún	ìkòkàndínlógún
20	Ogún	--	ogún (+N)	(N+) ogún
30	ogbòn	--	ogbòn (+N)	(N+) ogbòn
35	àrúndínlógójì	aárúndínlógójì	márúndínlógójì	ìkarúndínlógójì
79	òkàndínlógòrín	oókàndínlógòrín	mòkàndínlógòrín	òkàndínlógòrín
100	ogórún-ún	--	ogórún-ún (+N)	(N+) ogórún-ún
148	ẹ̀jídínlǎáádòójọ	eẹ̀jídínlǎáádòójọ	mẹ̀jídínlǎáádòójọ	ìkẹ̀jídínlǎáádòójọ
200	Igba	--	igba (+N)	(N+) igba
10000	ẹgbàárún	--	ẹgbàárún (+N)	(N+) ẹgbàárún

The derivation of the counting, adjectival and ordinal series has already been discussed (see Awobuluyi (2001), Olubode-Sawe (2010)). There are no long forms for *ogún*, *ogbòn* and round figures above 100. (In fact, the long forms for 11-99 are based on the occurrence within them of *òkan* ‘one’ to *ẹ̀sán* ‘nine’). The adjectival and ordinal forms of those larger numbers also have the same shape as the cardinal numerals but the position of the noun is shown in brackets. ‘10,000 books’ will be *ẹgbàárún ìwé* while ‘the 10,000th book’ is *ìwé ẹgbàárún*.

The complexity of numeral derivation in Yoruba is due to many factors, including but not limited to what follows. Higher numbers are compounded from the cardinal forms and the process of compounding involves series of mathematical operations. The products of these operations are then subjected to complex phonological processes which produce forms that differ, sometimes radically, from their constituent bases. Yoruba also has a multiplicity of number scales (or ‘bases’). Finally, in higher numerals, place value changes are unpredictable. These issues will now be discussed in turn.

2. Mathematical Processes in Yoruba Number Derivation

One of the sources of complexity in the numeral system is that number derivation in Yoruba is by a compounding of the cardinal numbers, involving several mathematical operations: addition, subtraction or multiplication and bracketing. In some numbers, all four processes may occur.

2.1 Addition

Addition occurs in isolation only in non-derived numbers: *ẹ̀wá* (10), *ogún* (20) and *ogbòn* (30). In derived numbers, it occurs in combination with the other processes. Typically, only *oókan* (1) to *ẹ́ẹ̀rín* (4) can function as addends to decades, other numbers in a decade being generated by subtraction of *aárún-ún* (5) – *oókan* (1). As the examples 11-183 in Table 2 show, addends are positioned before the number they are added to, followed by *lé* (exceeds) or *lé ní* (exceeds by) (Oyelaran 1980). Note, however, that in higher numerals, there could be exceptions, as the number words for 187 and 50009 show below. In higher numbers, *mẹ̀wàá* (10) and *okòó* (score) are addends in 290 and 223 respectively. Derived numbers can also be added: 13 in 213, 100 in 3100 and 600 in 5678. The changing position of the addends is one source of complexity.

In the case of numbers up to 99, the position of the addend is a reversal of the Hindu-Arabic system. After that, it would seem that addends follow the Hindu-Arabic pattern with the addends being placed after the base number, introduced by *ó lé* (it exceeds). Take for example *igba ó lé mètàlää* ($213 = 200 + 13$) and *egbòkàndínlógún ó lé ọgọ̀rùn-ún ó lé kan* ($3901 = 200 \times (-1 + 20) + (20 \times 5) + 1$). In the latter example, addition is recursive, 100 and 1 being added to 3800 in turn. However, there are counter examples in *okòó lé lẹgbẹ̀ta* ($620 = 20 + (200 \times 3)$) and *ọ̀rìnlúgba ó lé mẹ̀wàá* ($290 = ((20 \times 4) + 200) + 10$). In the first, the addend is placed before the base number, and the latter number has addends before and after the base number.

Table 2: Some Yoruba Numbers Generated through the Process of Addition

Symbol	Yoruba Number Word	Literal Translation	Computation
11	oókànlää	one plus ten	$1+10$
12	eéjilá	two plus ten	$2+10$
13	ẹ̀ẹ̀tálá	three plus ten	$3+10$
14	ẹ̀ẹ̀rìnlää	four plus ten	$4+10$
23	ẹ̀ẹ̀tálélógún	three plus twenty	$3+20$
34	ẹ̀ẹ̀rìnlélógbòn	four plus thirty	$4+30$
183	ẹ̀ẹ̀tálélógbòsàn-án	three plus nine-twenties	$3 + (20 \times 9)$
187	ọgọ̀sàn-án ó lé méje	nine-twenties plus seven	$(20 \times 9) + 7$
213	igba ó lé mètàlää	two-hundred plus three-plus-ten	$200+(3+10)$
223	okòó lé lẹ̀rúgba ó lé mẹ̀ta	one score plus two-hundred plus three	$(20 + 200) + 3$
290	ọ̀rìnlúgba ó lé mẹ̀wàá	four-twenties plus than two-hundred plus ten	$((20 \times 3) + 200) + 10$
450	ọ̀jì lé nírínwó ó lé mẹ̀wàá	two-twenties plus four-hundred plus ten	$(20 \times 2) + 400 + 10$
620	okòó lé lẹgbẹ̀ta	a score plus three two-hundreds	$20 + (200 \times 3)$
3100	egbẹ̀édógún ó lé ọgọ̀rùn-ún	fifteen two-hundreds plus one hundred	$200 \times (20-5) + (20 \times 5)$
3901	egbòkàndínlógún ó lé ọgọ̀rùn-ún ó lé kan	nineteen two-hundreds plus one hundred plus one	$200 \times (-1 + 20) + (20 \times 5) + 1$
5678	ẹ̀ẹ̀dẹgbàáta ó lé egbẹ̀ta ó lé èjìdínlọgọ̀rìn	one thousand removed from three two-thousands plus three two-hundreds plus two removed from four-twenties	$-(200 \times 5) + ((200 \times 10) \times 3) + (200 \times 3) + (-2 + (20 \times 4))$
50009	egbàá lóna mẹ̀ẹ̀édógbòn ó lé mèsàn-án	two thousand in thirty-less-five places, plus nine	$(200 \times 10) \times (30-5) + 9$

2.2 Subtraction

Subtraction can occur in isolation in both derived and non-derived numbers, and in combination with the other processes. Typically, only *àrùn* (5) – *ọ̀kan* (1) can function as subtrahends from decades and up to 179, positioned before the number from which they are subtracted, introduced by *dín* or *dín ní* (deficit). After that, they are positioned

after the minuend, in Hindu-Arabic order of place value. The changing position of the subtrahends is another source of complexity.

The decades from 40 to 180 are generated as multiples of twenty, and the intermediate numbers 50 to 170 are computed as multiples of twenty with ten subtracted from the product. Thus 50 is reckoned as three-twenties less 10 (*àádòtá < ẹwá dín nínú ọgọta*) and 170 is nine-twenties less 10 (*àádòsàn-án < ẹwá dín nínú ọgòsàn-án*). The process of subtraction is also used in generating odd multiples of hundred from multiples of *igba* (200): see 500 (*ẹ̀ẹ̀dẹ̀gbẹ̀ta < ọ̀rún dín nínú ẹgbẹ̀ta*) and 700 (*ẹ̀ẹ̀dẹ̀gbẹ̀rin < ọ̀rún dín nínú ẹgbẹ̀rin*) in Table 3 below. Subtraction is also involved in generating some odd multiples of thousand from *ẹgbẹwá* (2000). For example, 5000 is reckoned as three two-thousands less one thousand (*ẹ̀ẹ̀dẹ̀gbààta < ẹgbẹ̀rún dín nínú ẹgbẹ̀wá mèta*).

There is a major problem associated with this: the subtrahends 100 and 1000 are identical in phonological form, hence the Yoruba proverb: *a à kì í ẹ́ẹ̀dẹ̀* (you don't pre-empt one who says, 'ẹ̀ẹ̀dẹ̀...'), for there is no knowing whether his 'ẹ̀ẹ̀dẹ̀...' means a deficit of 100 or 1000. The two forms are generated by different phonological processes, which will be discussed later.

Table 3: Some Yoruba Numbers Generated through the Process of Subtraction

Symbol	Yorùbá Number Word	Literal Translation	Computation
15	ẹ̀ẹ̀dógún	twenty less five	$-5 + 20$
16	ẹ̀ẹ̀rindínlógún	twenty less six	$-4 + 20$
27	ẹ̀ẹ̀tádínlògbòn	thirty less three	$-3 + 30$
46	ẹ̀ẹ̀rindínláàádòtá	three-twenties-less-ten, less four	$-4 - 10 + (20 \times 3)$
50	àádòtá	three-twenties-less-ten	$-10 + (20 \times 3)$
75	àárundínlógòrin	four-twenties-less-five	$-5 + (20 \times 4)$
90	àádòrùn-ún	five-twenties-less-ten	$-10 + (20 \times 5)$
148	ẹ̀ẹ̀jìdínláàádòjọ	eight-twenties-less-ten, less two	$-2 - 10 + (20 \times 8)$
170	àádòsàn-án	nine-twenties-less-ten	$-10 + (20 \times 9)$
179	oókàndínlógòsàn-án	nine-twenties less one	$-1 + (200 \times 9)$
198	igba ó dín méjì	two-hundred less two	$200 - 2$
219	okòó léerúgba ó dín kan	one score plus two-hundred minus one	$(20 + 200) - 1$
300	ọ̀ọ̀dúnrún	four-hundred less five-twenties	$-(20 \times 5) + 400$
335	ọ̀tádín-nírínwó ó dín máàárùn-ún	four-hundred less three-twenties, less five	$-(20 \times 3) + 400 - 5$
390	okòó dín nírínwó ó lé mēwàá	four-hundred less one score, plus ten	$(-20 + 400) + 10$
500	ẹ̀ẹ̀dẹ̀gbẹ̀ta	a hundred removed from three two-hundreds	$-100 + (200 \times 3)$
700	ẹ̀ẹ̀dẹ̀gbẹ̀rin	a hundred removed from four two-hundreds	$-100 + (200 \times 4)$
5000	ẹ̀ẹ̀dẹ̀gbààta	one thousand removed from three two-thousands	$-(200 \times 5) + ((200 \times 10) \times 3)$

2.3 Multiplication

Multiplication is used in generating decades, hundreds and thousands. Multiplicands are base numbers *ogún* (20) *igba* (200), and derived bases *ẹgbàá* (2000) and *ẹgbàáwàá* (20000). The decades from 40 to 180 are generated as multiples of twenty, and higher numbers as multiples of 200, 2000 or 20000 as may be appropriate. 10, 100, 1,000 and 10,000 never act as multiplicands, though the first three do serve as subtrahends to generate intermediate decades, hundreds and thousands. In addition, 10 is also a multiplier in generating 2,000 from 200, and 20,000 from 2,000.

In higher multiples, there is a superficial confusing fluidity in the base number to be used as a multiplicand: seemingly swinging from 200 (600-18000), to 2000 and then back to 200. A closer look would show that the choice of multiplicand to be used is determined by the need to keep the multiplier within the range of 2-19. For example, from 600 – 3800, the multiplicand is 200 and the multipliers 2-19. Then from 4000 to 38,000, the next convenient multiplicand is 2000, with the same multipliers earlier stated.

Starting from 40,000 (*ẹgbàáwàá ọ̀nà méjì*), 20,000 is the multiplicand except where a whole number between 2 and 19 cannot be used as a multiplier. To generate 50,000 as a multiple of 20,000, the multiplier required would be 2.5 and that is not permitted at this level. Therefore, a lower multiplicand (2000) and an appropriate higher multiplier (25) are selected to get *ẹgbàá lóna mẹ̀ẹ̀dógùn* (two thousand in thirty-less-five places).

Table 4: Some Yoruba numbers generated through the process of multiplication

Symbol	Yorùbá Number Word	Literal Translation	Computation
40	ogójì	two twenties	20×2
60	ogóta	three twenties	20×3
100	ogórùn-ún	five twenties	20×5
140	ogòje	seven twenties	20×7
200	igba	two-hundred	200
600	ẹgbẹta	three two-hundreds	200×3
1000	ẹgbẹrún	five two-hundreds	200×5
1600	ẹgbẹjọ	eight two-hundreds	200×8
2000	ẹgbẹwá / ẹgbàá	ten two-hundreds = two-thousand	200×10
3000	ẹgbẹ̀dógún	fifteen two-hundreds	$200 \times (20 - 5)$
3800	ẹgbòkándínlógún	nineteen two-hundreds	$200 \times (-1 + 20)$
6000	ẹgbàáta	three two-thousands	$(200 \times 10) \times 3$
10,000	ẹgbàárùn-ún	five two-thousands	$(200 \times 10) \times 5$
12,000	ẹgbàáfà	six two-thousands	$(200 \times 10) \times 6$
20,000	ẹgbàáwàá	ten two-thousands = ten two-thousands	$(200 \times 10) \times 10$
30,000	ẹgbàá lóna mẹ̀ẹ̀dógún	two-thousand in twenty-less-five places	$(200 \times 10) \times (20 - 5)$
34,000	ẹgbàá lóna mètàdínlógún	two thousand in twenty-less-three places	$(200 \times 10) \times (20 - 3)$
40,000	ẹgbàáwàá ọ̀nà méjì	ten two-thousands in two places	$((200 \times 10) \times 10) \times 2$

50,000	ẹgbàá lóna mḕẹ̀ẹ̀dògbòn	two thousand in thirty-less-five places	$(200 \times 10) \times (30-5)$
60,000	ẹgbàáwàá ọ̀nà mḕta	ten two-thousands in three places	$(200 \times 10) \times 10 \times 3$
90,000	ẹgbàá lóna márùndínlógóta	two-thousand in three-twenties-less-five places	$(200 \times 10) \times (-5 + (20 \times 3))$
100,000	ẹgbàáwàá ọ̀nà márùn-ún	ten two-thousands in five places	$(200 \times 10) \times 10 \times 5$
900,000	ẹgbàáwàá ọ̀nà márùndínlǎàádótá	ten two-thousands in three-twenties-less-ten-less five places	$((200 \times 10) \times 10) \times (-5 - 10 + (20 \times 3))$
1,000,000	ẹgbàáwàá ọ̀nà àádótá	ten two-thousands in three-twenties-less-ten places	$(200 \times 10 \times 10) \times (-10 + (20 \times 3))$

Abraham (1958) gives no information on how intervening numbers like 950,000 are generated, but it can be assumed that the rule about not using fractions as multipliers would apply and that would rule out 20,000 which would have to be multiplied by *méjìdínlǎàádótá-àbò* (47.5). If the next lower multiplicand (2000) is used, the number generated (*ẹgbàá lóna ọ̀rínlénínwó ó dín márùn-ún*) would be ambiguous, and could be interpreted as $2000 \times (480-5) = 950,000$ or $(2000 \times 480) - 5 = 959995$. The other option is to use a combination of place values.

Table 5: Computing 950,000

Yorùbá Number Word	Symbol	Literal Translation	Computation
ẹgbàáwàá ọ̀nà méjì-àbò dínlǎàádótá*	950,000	ten two-thousands in three-twenties-less-ten-less two-and-half places	$((200 \times 10) \times 10) \times (-2\frac{1}{2} - 10 + (20 \times 3))$
ẹgbàá lóna ọ̀rínlénínwó ó dín márùn-ún ?	950,000 OR 959995	two-thousand in four-hundred plus four twenties-less-five places OR two-thousand in four-hundred plus four twenties places, less five	$(200 \times 10) \times ((20 \times 4) + 400-5)$ OR $(200 \times 10) \times ((20 \times 4) + 400) - 5$
ẹgbàáwàá ọ̀nà márùndínlǎàádótá ó lé ẹgbàá lóna mḕẹ̀ẹ̀dògbòn	950,000	ten two-thousands in three-twenties-less-ten-less five places plus two thousand in thirty-less-five places	$((200 \times 10) \times 10) \times (-5 - 10 + (20 \times 3)) + (200 \times 10) \times (30-5)$

Two multiplicands are utilized in generating 950,000: ẹgbàáwàá (20,000) and ẹgbàá (2000). Appropriate multipliers (generated by multiplication and subtraction) are then used to multiply them, and the two multiples are then added: $(20,000 \times 45) + (2000 \times 25)$, i.e. $900,000 + 50,000$.

The use of *ọ̀nà/lónà* (times) in the higher numerals is a source of complexity in reckoning Yoruba numbers because of the ambiguity introduced. When combined with the phrase for introducing addends (*ó lé*) and subtrahends (*ó dín*), it becomes difficult to determine which particular place value has been added to or subtracted from. *Ẹgbàá lóna mḕẹ̀ẹ̀dògbòn ó lé mēsàn-án* could conceivably be reckoned as (2000

$\times 25+9) = 68,0000$ or $(2000 \times 25)+ 9= 50009$. Only a highly numerate native speaker of Yoruba would know that *mẹ̀ẹ̀édògbòn ó lé mèsàn-án* (25+9) is not a possible sum that can be used as a multiplier; the correct ‘formula’ would have to be *mẹ̀rìnlélògbòn* (30+4). Such a speaker would therefore correctly compute *ẹgbàá lóna mẹ̀ẹ̀édògbòn ó lé mèsàn-án* as 50009, i.e. $(2000 \times 25) + 9$.

1.4 Division

It is a matter of debate whether the Yoruba traditionally utilized division in reckoning numbers. The use of some fractions shows that the concept of division was known. *Ìdajì*, literally, a division into two ($\frac{1}{2}$) and *ilàrin*, a slicing into four ($\frac{1}{4}$) are commonly used number words. Of greater interest are number values that have variant renderings, especially in counting cowries. For example, *ẹgbàá lóna mẹ̀ẹ̀édògbòn* is the same as *òkẹ méjì-àbò*. Table 6 below shows some more examples.

Table 6: Counting in Cowries

number of cowries	string (cowries÷40)	head (strings÷50)	sac (heads÷10)
40	1	-	-
2000	50	1	-
20,000	500	10	1
50,000	1250	25	2½

Some of the examples shown above are seen as examples of multiplication rather than division. This scenario may suggest otherwise. Imagine that a farmer brings a very huge pile of yams, and would like to sell them to retailers. He claims there are 200 yams in the heap but the retailer would need to ascertain that claim. What she would need to do is to first of all choose a divisor value, say 5 or 40; make smaller heaps using the divisor chosen and count the number of heaps. If her divisor was 5, she would have 40 groups of five, termed *ilé*, and if the divisor chosen was 40, she would have 5 groups of 40, termed *owó*. The practice of re-denominating bigger values by changing place values involves division.

Dividing by *owó* is still used in bulk sales today. On a visit to a farm produce market in Owena, Ondo State in 2009, this author participated in the bulk purchase of oranges. These are counted in dozens and dropped into a PET sac. For each dozen put in the bag, the seller put one orange in a small basket. At the end, she then counted the oranges in the basket to calculate how many dozens she had in the PET sac. Here division and multiplication are complementary.

3. Some Phonological Processes in Yoruba Number Word Derivation

A major source of complexity is that the final phonological shape of Yoruba numerals may differ radically from the input units. This means they are subject to some complex phonological processes which produce forms that sound from their constituent bases. This may make them a challenge to interpret. Table 7 below shows some of the processes.

Table 7: Some Phonological Processes in Yoruba Number Word Derivation

Number	input	output	processes involved
11	oókan lé ẹwá	oókànlá	deletion
15	àrún dín ní ógún/ ẹrún dín ní ogún	ẹẹdógún	deletion, assimilation
40	ogún ẹ̀jì	ogójì	coalescence
50	ẹwá dín nínú ọgọta	àádọta	elision
60	ogún ẹta	ọgọta	coalescence
100	ogún ọrún	ọrún	assimilation, deletion, clipping
300	ọrún dín nínú irínwó	ọ̀ọ̀dúnrún	assimilation, deletion
700	ọrún dín nínú ẹgbẹ̀rín	ẹẹdẹgbẹ̀rín	assimilation, deletion
2000	igba ẹwá	ẹgbàá	segment and tone deletion; TR harmony
5000	ẹgbẹ̀rún dín nínú ẹgbẹ̀wá mẹta	ẹẹdẹgbàáta	clipping, assimilation, deletion
20,000	ẹgbàá ẹwà	ẹgbàáwàá	deletion

Segment deletion is a very important process in generating Yoruba numerals. For example, in generating *ẹẹdógún* from *ẹrún dín ní ogún*, the phrase ‘dín ní’ /dĩ nĩ/ is reduced to /d/ by the loss of three segments. Sometimes, whole syllables are clipped off after assimilation as in *ogún ọrún* > *ogóọrún* > *ọrún* and *ogún ẹ̀jì* > *ogóòjì* > *ọ̀jì*. *Ọ̀ọ̀dúnrún* is similarly generated from *ọrún dín ní irínwó*.

In deriving compounds of *ogun*, the operative process is coalescence, defined by Awobuluyi (1987:6) as a fusion of some characteristics of two linguistic units to produce a third distinct unit of the same general kind. Two contiguous segments at the underlying representation are replaced at the surface phonetic level by a third segment which has some features of those two contiguous segments (Oyebade 2004:75). Examples of coalescing vowels are /ũ/ + /e/ → /o/ (in *ogún ẹ̀jì* → *ogóòjì*; *ogún ẹ̀je* → *ogóòje*) and /ũ/ + /ε/ → /ɔ/ (in *ogún ẹta* → *ogóòta*; *ogún ẹ̀jo* → *ogóòjo*).

In generating compounds of *igba*, the first step is vowel and tone deletion, and the second, Tongue Root harmony. TR harmony refers to the characteristic in Standard Yorùbá for +ATR mid-vowels (/e, o/) to co-occur only with other +ATR vowels, and for -ATR mid-vowels (/ε, ɔ/) to co-occur with other -ATR vowels, including ‘a’.

Owolabi’s (1989: 222-223) formulation on compounding in Yoruba numerals is as follows. When two words combine to form a compound numeral, the second vowel of the first word and its tone are deleted as shown below:

igba	+	ẹ̀je	→	igb	+	ẹ̀je
igba	+	ẹta	→	igb	+	ẹta
igba	+	ẹ̀jo	→	igb	+	ẹ̀jo
igba	+	àrún	→	igb	+	àrún

Then the first vowel of the second numeral is then said to harmonize with the remaining vowel of the first numeral (by assimilation across segments) to produce the following:

igb + èje	→	igb èje	→	<i>egbèje</i>	‘1400’
igb + èta	→	igb èta	→	<i>egbèta</i>	‘600’
igb + èjo	→	igb èjo	→	<i>egbèjo</i>	‘1600’
igb + àrún	→	igb àrún	→	*agbàrún	

This formulation does not explain how *egbèrun* is derived from *igba+àrun*. The problem is resolved if we realise that *igba* has a variant, *egba* which occurs in compound numerals (Awobuluyi 2008:98). The second vowel of the first word and its tone are deleted, as shown below:

egba + èje	→	egb + èje
egba + èta	→	egb + èta
egba + àrun	→	egb + àrun
egba + èwàá	→	egb + èwá

The process generates the final form *egbèje* in the first example. In the other examples, ATR harmony specifies that the -ATR vowels ‘ẹ’ and ‘a’ should co-occur with another -ATR vowel, ‘ẹ’.

egb + èje	→	<i>egbèje</i>		‘1400’
egb + èta	→	<i>egbèta</i>	→	<i>egbèta</i> ‘600’
egb + àrun	→	<i>egbàrun</i>	→	<i>egbèrún</i> ‘1000’
egba + èwá	→	<i>egbèwá</i>	→	<i>egbèwá</i> ‘2000’

In the last example, the labio-velar approximant /w/ may also be deleted to get ‘*egbèá*’ from which *egbàá* is generated by assimilation.

4. The use of non-analytic numbers

Apart from the mathematical and phonological processes which have been identified as sources of complexity, Yoruba attests a few number words that do not fit in neatly in their groups, seeming like insertions. *Ogbòn* for 30 is irregular in a vigesimal system that generates decades as multiples of twenty, and the intermediate numbers as multiples of twenty less ten. Since 50 and 130 are *àádóta* and *àádóje*, 30 could have been computed as two twenties less ten, *àádójì* (i.e. *èwá dín nínú ogójì*), 400 as *egbèjì* rather than *irínwó* and 300 as *èédégbèjì*. These sudden shifts from analytic to non-analytic would be difficult for learners. The use of *okòó* for ‘twenty’ as an addend to *igba* and its multiples presents a similar problem. *Okòó* < *okò owó* and *irínwó* < *irin owo* seem to be relics of an earlier vigesimal system where *okòó lònà okòó* (a score in a score places) equals *irínwó*.

5 Multiplicity of number scales

Perhaps the greatest source of complexity in the Yoruba number system is the multiplicity of number scales. By number scale is meant an ordered series of graduated values of numbers. Yoruba has a denary or decimal number scale: based on

10, and using multiples/ derivatives of 10 e.g. 1 - 14. It also has a vigesimal number scale, based on 20 and using multiples/ derivatives of 20 ($200 = 20 \times 10$; $400 = 20 \times 20$). Other series are derived by a combination of the two scales: $2000 = 20 \times 10 \times 10$, and $20,000 = 20 \times 10 \times 10 \times 10$.

What this means is that the Yoruba numeral system would not fit into the decimal gradation that has become well known with the Hindu-Arabic system, where every higher place value is ten times larger than the one below: tens, hundreds, thousands, ten thousands, hundred thousands, millions, ten millions, hundred millions, etc and arranged so that the higher place value comes before the lower. The format for Yoruba numbers displaying the correct place values would be: units, tens, twenties, two-hundreds, two-thousands, and twenty-thousands. In addition, for each place value, it will be necessary to specify whether a number is negative or positive. For example, the value of 13 is 1 ten and three positive units, 15 is 1 twenty and five negative units, 290 is 1 two-hundred, four twenties and 1 ten. Table 7 presents a format that displays the complexity arising from the multiplicity of place values.

Though 'hundred' and 'thousand' are not discrete place values in the Yoruba counting system, they have been included on the table as place values with a negative value, because each only occurs as a 'subtrahend bundle' (ẹ̀ẹ́dẹ́) in numbers reckoned by subtraction. They are never minuends nor do they participate in addition or multiplication. *Ogún* (20), *igba* (200) and *irínwó* (400) always have a plus value, as do the derived bundles *egbàá* (2000) and *egbààwàá* (20,000), and with the exception of *irínwó*, can be multiplied. However, all of them can be added to or subtracted from.

Table 7: Complexity of Place Value in Yoruba Number System

		20000	2000	1000	400	200	100	20	10	1-9
		+	+	-	+	+	-	+	-	+
4	ẹ́ẹ́rin									4
13	ẹ́ẹ́tálá								1	3
15	ẹ́ẹ́dógun							1	0	5
20	ogún							1	0	0
40	ogójì							2	0	0
46	ẹ́ẹ́rìndínláàádọ́ta							3		1
50	àádọ́ta							3		1
90	àádọ́rùn-ún							5		1
100	ogórùn-ún							5	0	0
140	ogóòje							7	0	0
183	ẹ́ẹ́tálélógòòsàn-án							9	0	3
198	igba ó dín méjì					1		0	0	2
200	igba					1		0	0	0
213	igba ó lé mètáláá					1		0	1	3
219	okòó léerúgba ó dín kan					1		1	0	
223	okòó léerúgba ó lé mēta					1		1	0	3
290	òrìnlúgba ó lé mēwàá					1		4	1	0
300	òódúnrún				1	0	1	0	0	0

301	òdúnrún ó lé kan				1	0	1	0		0		1	
390	okòò dín nírínwó ó lé mēwàá				1	0			1	1		0	
400	irínwó				1	0		0		0		0	
450	òjì lé nírínwó ó lé mēwàá				1	0		2		1		0	
480	òrìn lé nírínwó				1	0		4		0		0	
500	ẹ̀ẹ̀dẹ̀gbẹ̀ta					3	1	0		0		0	
620	okòò lé lẹ̀gbẹ̀ta					3		1		0		0	
1000	ẹ̀gbẹ̀rún					5		0		0		0	
2000	ẹ̀gbàá	1				0		0		0		0	
3100	ẹ̀gbẹ̀ẹ̀dógún ó lé ọ̀gọ̀rùn-ún					15		0		5		0	
3901	ẹ̀gbẹ̀kàndínlógún ó lé ọ̀gọ̀rùn-ún ó lé kan					19		0		5		1	
4000	ẹ̀gbàájì		2			0		0		0		0	
5678	ẹ̀ẹ̀dẹ̀gbàáta ó lé ẹ̀gbẹ̀ta ó lé èjìdínlógòrìn		3	1	3			4					2
10000	ẹ̀gbàárùn-ún		5		0	0							
12000	ẹ̀gbàáfà		6										
20000	ẹ̀gbàáwàá	1	0			0		0		0		0	
34000	ẹ̀gbàá lònà mètàdínlógún		17										
40000	ẹ̀gbàáwàájì	2											
50009	ẹ̀gbàá lònà mēẹ̀ẹ̀dẹ̀gbòn ó lé mēsàn-án		25										9
60000	ẹ̀gbàáwàá lònà mēta	3											
70000	ẹ̀gbàá lònà mārùndínlógójì		35										
1,000,000	ẹ̀gbàáwàá ọ̀nà àádọ̀ta	50											

More complexities would arise if the numbers analyzed above were to be used in Arithmetic. A simple sum of five thousand, six hundred and seventy-eight plus three thousand, nine hundred and three (in Sum A) is *ẹ̀ẹ̀dẹ̀gbàáta ó lé ẹ̀gbẹ̀ta ó lé èjìdínlógòrìn* plus *ẹ̀gbẹ̀kàndínlógún ó lé ọ̀gọ̀rùn-ún ó lé mēta* in Yoruba (Sum B). Just as in the Hindu-Arabic system where tens are converted into hundreds and hundreds to thousands, some place value conversions were necessary: *ogún* to *igba*, and *igba* to *ẹ̀gbàá*. Moreover, place values that did not feature in the numbers to be added had to be inserted, for example, the subtrahend *ẹ̀ẹ̀d-* ‘hundred’ which was generated in the process of converting *ogún* to *igba*.

Sum A: (Hindu-Arabic Numeration Style)

		Th	H	T	U
		5	6	7	8
	+	3	9	0	3
step 1	=	8	15	7	11
step 2	re-compute (units as tens)	8	15	8	1
step 3	re-compute (hundreds as thousands)	8+1	5	8	1
step 4	Finish	9	5	8	1

Sum B: (Yoruba Numeration Style)

		+Tw-TH <i>ẹgbàá</i>	-Th <i>ẹ̀ẹ̀d-</i>	+Tw-H <i>igba</i>	-H <i>ẹ̀ẹ̀d-</i>	+TW <i>ogún</i>	T (+/-) <i>ẹ̀wá/ àád-</i>	U (+/-)
		3	-1	3		4	0	-2
	+			19		5	0	+3
step 1	=	3	-1	22		9	0	1
step 2	re-compute (ogún → igba)	3	-1	23	-1	4	0	1
step 3	re-compute (igba → ẹgbàá)	3+2	-1	3	-1	4	0	1
step 4	finish	5	-1	3	-1	4	0	1

Needless to say, the answer of Sum B: 5,-1,3,-1,401 (*ẹ̀ẹ̀dẹ̀gbàárùn-ún ó lé ẹ̀ẹ̀dẹ̀gbẹ̀ta ó lé ọ̀kànlélógorin*) is equal to the answer in Sum A: 9,581 (nine thousand, five hundred and eighty-one). The process of generating the first answer is much less cumbersome than the other.

6. Conclusion

This paper has attempted to show some of the complexities of the Yoruba counting system. As has been discussed, these complexities derive from the mathematical operations and phonological processes involved in compounding of higher numbers from the cardinal forms. This discussion has focussed on how these numbers are reckoned and named; and not how they can be used in Mathematics. That, as has been demonstrated in the section above, would present challenges that would be almost insurmountable to school age children.

It is therefore a matter of urgency for a forum for standardizing the different proposals for simplifying the Yoruba numeral system to be convened. This need was reiterated at the Linguistic Association of Nigeria workshop on 'Numeral Systems of Nigerian Languages', which was held at the University of Port Harcourt on the first of December, 2010. Speaking at the Workshop, Professor Nolue Emenanjo wondered why the decimalization of the Yoruba number system has lagged so far behind that of Igbo, considering that the decimalization proposals for both were mooted in the 1970s.

Nevertheless, traditional Yoruba numeration should be preserved and taught as part of university courses in Mathematics. The 'fascinating chapter in the history of mathematics and the development of human thought' should not be forgotten.

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Modification of the Yoruba Numeral System for Use in Mathematics, Science and Technology

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The English language is today the *primus inter pares* in the study of mathematics, science and technology (MST). It has become the dominant language in all scientific fields, including teaching, academic education, research publications, meetings, conferences and in scientific societies. Even closely related languages, like French, Spanish, German and Italian, with the same genealogy strive to keep up with the daily expansion of English. While these other languages can easily adapt to continual developments in MST, the Yoruba language presently does not have that luxury. Therefore, students in Yoruba speaking areas receive their education in the sciences mainly through English or French medium. In spite of many studies pointing to the benefits of early education in MST in the mother tongue¹⁻⁶, some issues are evident concerning implementing this idea. One of these has to do with the complexity of the Yoruba numeral system. The numeral system is, of course, the basic tool of mathematics while mathematics, according to Yoloye, “is often regarded as a language of and a link between all the sciences”⁷

Introduction

It must be emphasized at the beginning of this paper that the Yoruba numeral system as it is today has a long and proud historical foundation⁸. It served our forebears well and its use is not being discouraged. However, the exigencies of science and technology advancement in general make some modification unavoidable⁹.

As it was pointed out, a Yoruba numeral system that can be used for MST must have the following attributes¹⁰:

1. It must be called as it is written.
2. It must be written as it is called.
3. It must be capable of handling numbers with as many figures as desired.
4. It must be able to do this in a timely fashion compared to other number systems.
5. It must be capable of being taught to a six-year old in its entirety.
6. Learning it must not become a chore in itself.
7. It must be capable of being easily manipulated.

Most of these conditions are either absent or difficult to meet with the Yoruba Numeral system as it is today.

Further attributes of such a numeral system is that it must be as ‘user-friendly’ and comparable in the number of words and letters with the English numeral system, with which it will be competing in schools and colleges. If these conditions are not met, such a system will find little or no acceptability among students already used to the latter.

This paper examines some ways numbers are expressed, formally and in abbreviated forms in the English language and makes comparisons with a proposed

modified Yoruba system. It posits that in the areas aforementioned, the modified Yoruba system compares favorably with the English system.

Proposed modification

The Yoruba numeral system - Yoruba Decimal System or YDS, herein proposed, is a slightly modified version of a system previously enumerated¹¹⁻¹². It responds to ideas and suggestions made in various quarters both in writings and during various presentations¹⁰.

This system keeps the usual fundamental numbers, *odo, okan, eji ... esan*, of the Yoruba vigesimal system intact and the usual designations for ten, *idi*, as taught in the schools. Instead of *apo* for hundred as previously suggested¹¹⁻¹², it reverses to the term *orun* - abbreviated form for *ogorun* for hundred⁸ - as it is commonly used. The terms for thousand, million and billion are left as *oke, odu and eeru* respectively. An explanation for the genealogy of these terms has been given previously⁹⁻¹⁰. These, therefore are the only three terms introduced to the numeral system in its conversion from the old vigesimal system to the proposed YDS.

The areas of interest included in the comparison between the proposed YDS and the English method of counting are the formal and informal numbering and dating. The major items compared are the number of words and letters within each name.

With the designations above, some YDS numbers can be called formally and informally as follows:

NUMBER	FORMAL YDS NUMBERING	INFORMAL YDS NUMBERING
59	Arun-idi l'esan (<i>Arun idi le esan</i>)	Arun l'esan
597	Arun-orun at'esan-idi l'eje	Arun at'esan l'eje
2,468	Eji-oke, erin-orun at'efa-idi l'ejo	Eji-oke, erin at'efa l'ejo
54, 689	Arun-idi l'erin oke, efa-orun at'ejo-idi l'esan	Arun l'erin oke, efa at'ejo l'esan
674, 821	Efa-orun, at'eje-idi l'erin oke, ejo-orun at'eji-idi le'kan	Efa at' eje l'erin oke, ejo at'eji le'kan
1,246,783	Odu kan, eji-orun at'erin-idi l'efa oke, eje-orun at' ejo-idi l'eta	Odu kan, eji at'erin l'efa oke, eje at' ejo l'eta
2,234,765, 432	Eeru kan, eji-orun at'eta-idi l'erin odu, eje-orun at'efa-idi l'arun oke, erin-orun at'eta-idi l'eji	Eeru kan, eji at'eta l'erin odu, eje at'efa l'arun oke, erin at'eta l'eji

NUMBER	INFORMAL YDS NUMBERING	INFORMAL ENGLISH NUMBERING
59	Arun l'esan	Fifty nine
597	Arun at'esan l'eje	Five ninety seven
2,468	Eji-oke, erin at'efa l'ejo	Twenty-four, sixty-eight
54, 689	Arun l'erin oke, efa at'ejo l'esan	Fifty-four thousand, six eighty nine
674, 821	Efa at' eje l'erin oke, ejo at'eji le'kan	Six seventy four thousand, eight twenty one
1,246,783	Odu kan, eji at'erin l'efa oke, eje at' ejo l'eta	One million, two forty six thousand, seven eighty three
2,234,765,4	Eeru kan, eji at'eta l'erin odu, eje	Two billion, two thirty four million,

32	at'efa l'arun oke, erin at'eta l'aji	seven sixty five thousand, four thirty two
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A direct comparison of these numbers is made below, both in the formal and formal designations:

Formal Numbering: Yoruba YDS System Versus English System

NUMBER			No. of words	No. of letters
59	YORUBA	Arun-idi l'esan	3	13
	ENGLISH	Fifty nine	2	9
597	YORUBA	Arun-orun at'esan-idi l'eje	5	23
	ENGLISH	Five hundred and ninety seven	5	25
2,468	YORUBA	Eji oke, erin orun at'efa-idi l'ejo	7	26
	ENGLISH	Two thousand, four hundred and sixty eight	7	33
54, 689	YORUBA	Arun l'erin oke, efa orun at'ejo idi l'esan	8	33
	ENGLISH	Fifty four thousand, six hundred and eighty nine	8	39
674, 821	YORUBA	Efa orun, at'eje-idi l'erin oke, ejo orun at'eji-idi le'kan	11	43
	ENGLISH	Six hundred and seventy four thousand, eight hundred and twenty one	11	56
1,246,783	YORUBA	Odu kan, eji orun at'erin-idi l'efa oke, eje orun at'ejo idi l'eta	13	48
	ENGLISH	One million, two hundred and forty six thousand, seven hundred and eighty three	13	65

Informal Numbering: Yoruba YDS System Versus English System

NUMBER			No. of words	No. of letters
59	YORUBA	Arun l'esan	2	9
	ENGLISH	Fifty nine	2	9
597	YORUBA	Arun at'esan l'eje	5	14
	ENGLISH	Five ninety seven	5	15
2,468	YORUBA	Eji oke, erin at'efa l'ejo	5	19
	ENGLISH	Twenty four, sixty eight	4	20
54, 689	YORUBA	Arun l'erin oke, efa at'ejo l'esan	6	25
	ENGLISH	Fifty four thousand, six eighty nine	8	30
674, 821	YORUBA	Efa, at'eje l'erin oke, ejo at'eji le'kan	7	29
	ENGLISH	Six seventy four thousand, eight twenty one	7	36
1,246,783	YORUBA	Odu kan, eji at'erin l'efa oke, eje at'ejo l'eta	9	34
	ENGLISH	One million, two forty six thousand, seven eighty three	9	45

Dating

The usual way to call annual dates in the English language eliminates the designations for thousand and hundred. This is easily done with the Yoruba decimal system. A comparison of the English and Yoruba informal way of naming dates for both are shown below.

Yearly Dates: Yoruba Versus English

DATE			No. of words	No. of letters
1167	YORUBA	(Odun) ikanle' kan at' efa l'eje	5	22
	ENGLISH	(The year) eleven sixty seven	5	23
1898	YORUBA	(Odun) ikan l'ejo at'esan l'ejo	5	22
	ENGLISH	(The year) eighteen ninety eight	5	26
2000	YORUBA	(Odun) eji oke	3	10
	ENGLISH	(The year) two thousand	4	18
2011	YORUBA	(Odun) eji oke at'ikan le'kan	5	21
	ENGLISH	(The year) two thousand and eleven <i>OR</i> twenty eleven	6(4)	27(19)
2078	YORUBA	(Odun) eji oke at' eje l'ejo	5	18
	ENGLISH	(The year) twenty, seventy eight	5	25

In calling days and months, the English language and the corresponding way proposed for the Yoruba numeral system are as follows:

Daily, Monthly, and Yearly Dates: Yoruba Versus English

DATE			No. of words	No. of letters
11/06/1949	YORUBA	Ojo kokanla, osu kefa (Juunu), odun idikanl'esan at'erin l'esan	8	41
	ENGLISH	Eleventh (day of the month of) June, nineteen forty nine	5	29
24/11/1966	YORUBA	Ojo eji-di l'erin, osu kokanlaa (Juunu), odun idikan l'esan at'efa l'efa	10	46
	ENGLISH	Twenty first (day of the month of) November, nineteen sixty six	6	35
25/11/2009	YORUBA	(Ojo) eji-di l'arun, osu kokanlaa (Juunu), odun eji-oke l'esan	8	39
	ENGLISH	Twenty fifth (day of the month of) November, (year) two thousand and nine	7	37
26/11/2012	YORUBA	(Ojo) eji-di l'efa, osu kokanlaa (November), odun eji-oke l'ejila	8	39
	ENGLISH	Twenty sixth (day of the month of) November, (year) twenty twelve	5	31

It is observed that, in most instances, except when calling dates along with the days and months, the proposed Yoruba numeral system contains about the same number of words, both in the formal or informal ways of calling these numbers, as the English

system. The number of letters used in calling numbers, clearly favours the use of the proposed Yoruba numeral system over the English version.

Conclusion

It can be concluded that the proposed Yoruba numeral system, along with the major advantage that it is indigenous to the Yoruba child, clearly has other advantages. These include the fact that they are, in comparison with the English number system, easier to learn and to write. Moreover, a child does not have to wait to learn the cumbersome way English words are generally spelt before mastering the number system.

It is not implied that the English number system should not be taught to the child as he progresses in his studies, but the concept of numbering itself, even up to the billion would have been built in the child. Only the translation of these numbers to English language will be involved. The child therefore can begin to manipulate these numbers earlier in his learning years instead of waiting some years to learn them in English.

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The Igbo Numeral System in Danger of Extinction: The Way Out

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The main thrust of this paper is to create awareness on the danger of extinction which is facing the Igbo numeral system and then suggest some ways of tackling such a sad situation. This paper adopts a descriptive approach in its investigation. The major findings of this paper are as follows: The Igbo people's attitude of not being loyal to their language and lack of qualified teachers to teach the Igbo numeral system very well are the major factors that have caused the danger of extinction that is facing the numeral system of the Igbo language. Besides, it has been observed that if the Igbo people should be loyal to their numeral system and qualified teachers are employed for its teaching and learning, then the numeral system of Igbo will survive and flourish.

1. Introduction

Igbo is a language that belongs to the New Benue-Congo group of languages and it is one of the three major Nigerian Languages. When language users want to use their language, they look for the appropriate linguistic expression(s) in the language that can best describe or explain what they intend to say. This implies that every language has different vocabularies and expressions appropriate for different fields, situations etc. The need for people to describe quantity and value necessitated the invention of the numeral system in languages. Before the invention of numbers language users were using sticks, pebbles, fingers etc. but the need to represent larger quantities easily necessitated the use of numbers. In this modern times people can use numeral system to represent conveniently any amount that they want but the problem is that that some language groups abandon the numeral asset of their language and go for what they think is easier and superior than their own and in that way lose their own numeral system or leave it at the verge of extinction. It is as a result of this attitude of disloyalty toward numeral system of language and the resultant effects that motivated us to use this paper as a forum to create awareness concerning the danger of extinction that is facing the Igbo numeral system and then suggest ways of getting rid of the problems that are likely to arise from the sad situation of the extinction of their numeral system.

2. Theoretical Background

Some scholars have done different works concerning the numeral system and therefore we deem it necessary to review some of those works so as to use them as bases for our own study.

The online *Encyclopedia Britannica* says that numeral system is any of various sets of symbols and the rules for using them to represent numbers, which are used to express how many objects, are in a given set. It goes further to claim that modern numeral systems are place-value system –that is, the value of symbol depends upon the position or place of symbol in the representation, for example, the 2 in 20 and 200 represents two tens and two hundreds respectively. According to the same source, the most commonly used numeral system is the decimal-positional numeral system, which is an invention of the Indians but perfected by medieval Islam.

Wikipedia's claim is similar to the above claim of *Encyclopedia Britannica* but specifically it holds that numeral system is a writing system for expressing numbers, that is, a mathematical notation for representing numbers of a given set, using graphemes or symbols in a consistent manner. The foregoing claim unveils the major features of numeral system which include its use in expressing numbers, and the consistency in the use of symbols or graphemes to represent numbers. Continuing Wikipedia, it notes that a numeral system will satisfy the following conditions: represent a useful set of numbers (example, all integers, or rational numbers), give every number represented a unique representation (or at least a standard representation) and reflect the algebraic and arithmetic structure of the numbers.

Ortenzi (1964) while discussing the origin of numbers notes that there was little need for numeric system until groups of people formed clans, villages and settlements and began a system of bartering and trade that in turn created demand for currency

In talking about the role of numeral system in a language, Sarangheyo (nd.) notes that it plays an important role in learning language when it comes to issues like time, price, how many, date, age etc. Winter's (1999) work on the numeral systems of Australian languages as cited in Epps (2011) shows that in their use of numeral systems, people seem to respond to the conditions and needs of their respective societies.

Troutman's (nd.) research on Babylonian's numbering system shows that they utilize units like tens, hundreds and thousands. He further notes that they express the idea of zero by leaving a blank space in place of zero.

Crystal (2000) as reported in Wikipedia opines that a language will progress if its speakers do the following: increase their prestige within the dominant community, increase their wealth, increase their legitimate power in the eyes of the dominant community, have a strong presence in the education system, can write down the language and can make use of electronic technology.

While discussing the major cause of endangerment of numeral system, Comrie and Chan (2011) have this to say, "... during rapid globalization, the act of counting in a minority language is left to older members of the community, while the younger generation often tend to shy away from native numerals and prefer to express numerals in English or some other dominant languages, with the result that the traditional numeral systems of most small languages are being rapidly replaced by those of dominant languages." Comrie (2005) in Comrie and Chan (2011) opines that even the numeral systems of large languages can be endangered in this way, e.g. Japanese and Thai numerals have been largely replaced by Chinese. From the foregoing statements, one is made to understand that endangerment of numeral systems is not peculiar to the minority languages but the whole issue lies on whether the owners of either the minority or majority languages use their native language numeral system or not.

3. The Issue of Igbo Numeral System

The Igbo language is one of the African languages with well represented numeral system from the value of one "otu" to billion "ijeri" but the problem is not a matter of its availability but that of use. We have said this because he who has something but does not make use of it is not better than the person who does not possess that thing at

all. Most of the time, the Igbo people of all ages are found abandoning the numeral system of their native language to the use of the numeral system of English even when the setting is purely an Igbo setting that even requires the use of Igbo numeral system. For instance, counting of money during payment of dowry in marriage ceremonies, business transactions at the local markets, village meetings etc. The major problem with the Igbo numeral system is the lack of use by the Igbo people even when the setting is purely a traditional Igbo setting as pointed out earlier.

The summary of the reason why they leave off their numeral system that God gave them as an aspect of their language is that they have respect for the English numeral system and therefore feel that using their own numeral system (Igbo) is useless and shows a mark of inexperience in the English numeral system which they value and use most of the time. Our claim is confirmed in Nwadike's (2008) observation that many Igbo people take pride in speaking other peoples' languages other than their own. On foreseeing the consequence of lack of use of a language or an aspect of a language, Crystal (200) as quoted in Sepulveda (2010) holds that once a language is no longer needed as a system of communication between speakers, it is on the road to extinction.

For people that may want to say that since the numeral system of the Igbo language is written down that it cannot die, then we will react to that idea by borrowing Sepulveda's (2010) notion that since languages in use by humans are constantly altering, a language preserved solely in records is frozen and cannot be considered alive. Based on this, we say that, the fact that the Igbo numeral system is on record does not mean that it cannot die considering the fact that it is rapidly losing its users. Most of the times, when Igbo people are required to say the amount of money or the value of a given number using the Igbo numeral system, what they usually say is, "Biko amaghị m otu m ga-esi kwuo ya n'Igbo" (please, I don't know how to say it in Igbo) and they will end up saying it in English and the people there always laugh as the last resort without knowing that they are indirectly paving way for the endangerment and extinction of their numeral system.

3.1 Factors Threatening the Igbo Numeral System

A. Disloyalty of the Language Users toward their Numeral System

When the native speakers of a given language do not value their numeral system and as a result of that, they resort to use the numeral system of another language which they feel is superior to their own, they are gradually pushing the numeral system of their language to the grave. It is in view of the above statement that Alamu (2010) posits that a language can move towards extinction as a result of a reduction in the number of speakers or users of the language. The issue of reduction in the number of users is seen among the Igbo native speakers in their refusal to use the Igbo numeral system in such settings where they suppose to use the Igbo numeral system like in their local markets, local churches, village meetings, traditional marriage ceremonies, village launching etc. In the aforementioned settings, they use English numeral system in negotiating prices of commodities in the local markets even among their fellow Igbo speakers, calling out chapters and verses of Bible portions, talking about their contributions at their village meetings, announcing the amount of money during

launching instead of the Igbo numeral system. Our above explanation shows why Alamu and Ugwuoke (2010) posit that the attitude of the speakers to a language determines the health of a language. So, this attitude of disloyalty of the Igbo people toward their numeral system is like a weevil eating a seed gradually, before you know it, it has damaged the seed.

B. Lack of Qualified and Experienced Teachers

Most times the students are not taught this Igbo numeral system the way it ought to be taught. Many Igbo teachers cannot express larger numbers like millions, billions and even dates of the year and in that situation, what they do is to avoid teaching those ones they do not know. Consequent upon this, they produce students who are half baked in the numeral system of the Igbo language and when this happens, the students always prefer using the English numeral system which they can easily express or at times they will cunningly write those numbers in figures like 103,578,961, #50,112,109.00, 29/12/1978 etc. to avoid failing them. This observation is similar to Oha's (2008) assertion that the teaching of the Igbo language discourages many would-be-students of the Igbo language because many of the teachers are unqualified and thus can hardly inspire their students.

C. Lack of Adequate Teaching Materials for Numeral System

Another factor threatening the Igbo numeral system is lack of adequate teaching materials that will facilitate the teaching and learning of the Igbo numeral system. Teaching materials are necessary for the teaching and learning of the Igbo numeral system because people learn easily when they see what they are learning.

3.2 Effects of Extinction of Numeral System

The extinction of the numeral system of the Igbo language will not only have drastic effect on the language users but on the language itself as will be discussed hereunder:

A. Difficulty in the Teaching and Learning of Igbo and Other languages

If in any case the Igbo language numeral system is faced out from the face of the earth as it is struggling to do, the Igbo people will not only find it difficult to express quantities in their language but the Igbo learners of the numeral system of other languages will find it very difficult to cope with the learning since they lack first language background on the numeral system. Besides, there is a general saying that children perform better when they are taught in their native language, so, using the numeral system of another language to teach Igbo children mathematics, statistics or anything that involves calculation will not only be difficult but will make the whole description vague to them. The idea of the students' well performance in their indigenous language is clearly shown in the statement of the Indian Nations at Risk Task Force carried out in 1991 as quoted in Reyhner (1995) that schools that respect and support a student's language and culture are significantly more successful in educating those students. So, based on this idea, Igbo students are likely to be more successful in subjects or courses involving the use of numeral system when they are

taught using the Igbo numeral system than when they are taught using the numeral system of another language.

B. Difficulty in the Buying and Selling among the Language Users

Every society is made up of literates and illiterates and so, in a situation where there is no Igbo numeral system, the people more especially the illiterates ones will find it very difficult to buy and sell since they cannot bargain the prices conveniently using another numeral system other than their own. When such a situation occurs, they are likely to go back to the old system of trade by barter which is stressful and very difficult.

C. Loss of a Great Gift from God

Language with all its components is a great gift of God to mankind, so the loss of the Igbo numeral system by the native speakers of Igbo is a loss of a crucial aspect of their language which God purposely gave them to be able to express quantities clearly. Our foregoing claim is in line with the claim of Blair, Rice, Wood and Janvier (2002), Foundation for Endangered Languages (2004) and UNESCO and Hoc Expert Group on Endangered Languages (2003) as cited in Mclvor (2009) that every time a language dies, unique and irrecoverable knowledge is lost.

D. Creating a Vacuum in the Igbo Language

With the extinction of the Igbo numeral system which forms one of the component parts of the Igbo language, there will be a great vacuum that will be very difficult if not impossible to fill in the Igbo language. Once it comes to such issues like expressing quantities, telling the time, talking about age, position, calculations etc., it will be impossible since there is no terminology again to use to describe them.

3.3 Suggestions

There is an adage which says that a cow will not know the usefulness of its tail until it loses it. The Igbo people will only know the value of their numeral system when they lose it. The following strategies should be adopted in order to save the Igbo numeral system from extinction since it is a very important aspect of their language.

A. The Igbo People should be Loyal to their Numeral System

The Igbo people should try to be loyal to their numeral system in its entirety. By this, we mean that they should not only use their numeral system in writing but they should use it orally in transacting their business. The need of being loyal to ones language is evident in Bamgbose's statement as cited in Idudhe (2010) that the fate of an endangered language lies in the hands of the owners of the language themselves and in their will to make it survive. Based on this, the parents of the Igbo people should try as much as possible to hand over their numeral system to their children and other younger ones and by so doing, they are making their numeral system to survive and flourish.

B. Provision of Teaching Materials for Teaching the Igbo Numeral System

The government should provide suitable teaching materials for the teaching and learning of the Igbo numeral system. These teaching aids will help to facilitate teaching and learning of the Igbo numeral system because people learn easily when they see what they are learning since there is a general view that seeing is believing.

C. Compulsory Test/Examination on Igbo Numeral System

Scholars and students in the primary and secondary schools respectively in the Igbo speaking states should be compulsorily examined each term on their use of the Igbo numeral system. This will act as an instrumental motivation to them since they know that they are expected to write and pass examination on the numeral system of their native language each term.

D. Inclusion of Igbo Numeral System as a Course in Higher Institutions

The Igbo numeral system should be taught as one of the courses for those students studying Igbo in the higher institutions of learning. This will help them to learn more about their numeral system and to apply the knowledge gotten from it in the learning of other aspects of Igbo if the need arises.

E. Creating Awareness on the Usefulness of Igbo Numeral System

Linguists should let the Igbo people understand that children learn better when they are taught in their native language and therefore calculations should be easier for them when they use numeral system of their native language. Moreover, they should be made to know that business transactions at the local level is easier and meaningful with the numeral system of their native language since most of them are illiterates who cannot negotiate prices of their products using the English numeral system like the literate ones.

F. Employment of Qualified Language Teachers

Qualified Igbo language teachers who can judiciously teach the numeral system of the Igbo language should be employed to help reduce teaching of the Igbo numeral system haphazardly by unqualified teachers.

4. Conclusion

Our discussion on the danger of extinction that is facing the Igbo numeral system reveals that disloyalty of the Igbo people toward their numeral system is the major factor that made the numeral system of Igbo to be in danger of extinction. Apart from this, lack of qualified and experienced teachers who can teach the numeral system of Igbo has seriously served as a factor that has led to the present state of the Igbo numeral system being in danger of extinction. The study also shows that when a numeral system of a language dies, it will not only have negative effects on the language but on the owners of that numeral system as shown in our discussion above. The research further shows that the loyalty of the Igbo people toward their numeral system as well as the employment of qualified teachers who can adequately handle the

Igbo numeral system will help to preserve the Igbo numeral system and keep it flourishing.

In conclusion, we have seen that the numeral system of the Igbo language is in danger of extinction and as a result of this, the attitudes of the Igbo people concerning their numeral system need to be changed since a numeral system that is not used by the speakers is not better than a dead numeral system. A numeral system is alive when it is used by the people. It is not enough to say that a language or an aspect of a language is alive when it is on record alone as evident in Sepulveda's (2010) claim that since languages in use by humans are constantly altering, a language preserved solely in records is frozen and cannot be considered alive.

5. Recommendations

Having seen the factors that can cause the extinction of the numeral system of a language and their resultant effects, we then recommend that the Igbo people should be loyal to the numeral system of the Igbo language by using it and transferring it to the younger ones. Again, the government should not only employ qualified Igbo teachers who can conveniently handle the numeral system of Igbo and but should as well provide relevant materials for its teaching and learning. All these strategies should be adopted by the Igbo people in order to save their numeral system because according to Chan (2011), an indigenous numeral system may be endangered even if the language is not itself endangered. So, based on our discussion so far, we then put an end to it by leaving this Igbo adage which says that, "*Emee ngwa emegharu odachi*" (a stitch in time saves nine) to all Igbo people to deliberate on it and act wisely.

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Counting: The Iḅani Way

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For anyone learning a language, one of the first things they learn, apart from the alphabet, is how to count in the language. Numerals are therefore an integral part of any language system. Usually, after the numbers 1 – 10, languages employ different methods in order to derive larger numerals. These methods may be via arithmetic operations such as subtraction, addition, multiplication and division; morphological processes such as affixation, reduplication, compounding, etc., or phonological processes such as elision, insertion, assimilation, etc. This paper describes the numeral system of Iḅani, the methods used in building up the system and their modes of operation. Iḅani is a threatened Eastern Ijò dialect spoken in Bonny and Opobo areas of Rivers State, Nigeria.

1. Introduction

Numerals are referred to as *kìḅbìbì* in Iḅani, a compound word made up of *kìḅ* ‘count’ and *bìbì* ‘mouth’. Iḅani numerals used for counting are of two types: cardinal and ordinal. The smallest unit of counting in Iḅani is ‘one’, while the largest unit of counting is ‘one thousand’. Iḅani operates a vigesimal system and so counting is done in the base of twenty. Fomḅo (1975:21-24) and Bẹ̀rẹ̀siri (2001) both have a list of some Iḅani numerals. Bẹ̀rẹ̀siri lists numbers 1 – 100, while Fomḅo lists numbers 1 – 51 and then 60, 70, 80 and so on, not following any particular order. However, there are a few inconsistencies in both works which this paper hopes to resolve in section 4.0. This paper differs from earlier works in that it discusses the methods employed in the derivation of Iḅani numerals. The orthographic conventions followed in this work include:

- a) All high tones are marked with an acute accent, downstepped high tones with a macron while low tones are left unmarked.
- b) Unexpanded (also known as narrow or [-ATR]) vowels are represented with a sub dot.

2. Cardinal numerals

Iḅani cardinal numerals constitute one way by which plurality in nouns can be expressed. They also function as prenominal modifiers. We can classify Iḅani cardinals into: simple and complex cardinal numerals.

2.1 Simple Cardinal Numerals

The simple cardinals are basic in form and are used in deriving other numerals. They include the numbers 1 – 10, 15, 20 and 400. The numeral 30 is considered basic in form and so is a simple cardinal but it is not used in the derivation of other numerals. This is due to the vigesimal nature of the Iḅani numeral system (30 is not a multiple of 20). The simple cardinals are listed below:

1.	ngìẹ	‘one’	íníne	‘eight’
	mmeẹ	‘two’	éséníé	‘nine’
	tẹrẹ	‘three’	atié	‘ten’
	íní	‘four’	jeé	‘fifteen’
	sónọ	‘five’	sí	‘twenty’
	sóníé	‘six’	só	‘thirty’
	sónọma	‘seven’	ńdẹ	‘four hundred’

With the exception of *ngìẹ* ‘one’ and *atié* ‘ten’, all other simple cardinals retain their basic forms when modifying nouns. As noun modifiers, the numbers ‘one’ and ‘ten’ are expressed as *gbẹrẹ* and *óyí* respectively. *Óyí* is also used whenever the numeral ‘ten’ combines with any other numeral to derive a larger number. A plural marker (PM) –*a*, whose tone is identical to the last vowel of its host (except for *jeé* which becomes *jeea*) is suffixed to numbers 4 – 10 and 15 when these numerals combine with either a noun (cf. 5 - 12) or another numeral (cf. 13).

Simple cardinal numerals + noun

- | | | |
|----|----------------|----------------|
| 2. | gbẹrẹ ìkasì | ‘one chair’ |
| | one chair | |
| 3. | mmeẹ ìkasì | ‘two chairs’ |
| | two chair | |
| 4. | tẹrẹ ìkasì | ‘three chairs’ |
| | three chair | |
| 5. | íníá ìkasì | ‘four chairs’ |
| | four-PM chair | |
| 6. | sónọ́á ìkasì | ‘five chairs’ |
| | five-PM chair | |
| 7. | sóníéá ìkasì | ‘six chairs’ |
| | six-PM chair | |
| 8. | sónọma ìkasì | ‘seven chairs’ |
| | seven-PM chair | |
| 9. | ínínea ìkasì | ‘eight chairs’ |
| | eight-PM chair | |

-
- | | | |
|-----|--------------------------------|------------------|
| 10. | éseníéá ìkasi
nine-PM chair | ‘nine chairs’ |
| 11. | óyíá ìkasi
ten-PM chair | ‘ten chairs’ |
| 12. | jeea ìkasi
fifteen-PM chair | ‘fifteen chairs’ |

13. *Simple cardinal numeral + another numeral*

ínínea sí	‘one hundred and sixty’ (eight score)
éseníéá sí	‘one hundred and eighty’ (nine score)
óyíá sí	‘two hundred’ (ten score)
jeea sí	‘three hundred’ (fifteen score)

2.2 Complex cardinal numerals

To derive larger numbers, it becomes expedient to develop a method or methods of expressing these complex cardinals. In Kalaḡari, a sister Eastern Ijò dialect, three methods are employed (Jenewari, 1977:323) and they also apply to Iḡani. These methods are arithmetic and include; addition, multiplication and subtraction. Note that some numerals utilise more than one method in their derivations.

2.2.1 By addition

This is achieved by the use of *fíndí* which is a form of *féndí* meaning ‘over’ (Fòmḡo, 1975:21). Such numbers as 11 – 14, 21 – 25, 31 – 35, 41 – 45, 51 – 55, 61 – 65, 71 – 75, 81 – 85, 91 – 95, 101 – 105, etc are derived by addition. For instance,

- | | | |
|-----|--|---|
| 14. | óyí ngìé fíndí
ten one over | ‘eleven’ (10 + 1) |
| 15. | óyí mmeḡé fíndí
ten two over | ‘twelve’ (10 + 2) |
| 16. | sí sònḡ fíndí
twenty five over | ‘twenty five’ (20 + 5) |
| 17. | só téré fíndí
thirty three over | ‘thirty three’ (30 + 3) |
| 18. | éseníéá sí ngìé fíndí
nine-PM twenty one over | ‘one hundred and eighty one’ (9 x 20 + 1) |

-
19. óyíá sí íní fíndí ‘two hundred and four’ (10 x 20 + 4)
ten-PM twenty four over

2.2.2 By multiplication

The multiplication method is achieved by multiplying a simple cardinal numeral by *sí* ‘twenty’ for the numbers 40, 60, 80, 100, 120, 160, 180, 200 and 300. For the numeral 800, a simple cardinal is multiplied by *ńdẹẹ* ‘four hundred’¹.

- | | | | |
|-----|-------------------|-----------------|-----------|
| 20. | mme sí | ‘forty’ | (2 x 20) |
| | tẹsí ² | ‘sixty’ | (3 x 20) |
| | íníá sí | ‘eighty’ | (4 x 20) |
| | sónóá sí | ‘one hundred’ | (5 x 20) |
| | óyíá sí | ‘two hundred’ | (10 x 20) |
| | jeeá sí | ‘three hundred’ | (15 x 20) |
| | mme ńdẹẹ | ‘eight hundred’ | (2 x 400) |

2.2.3 By subtraction

This method is achieved by the use of *fá* meaning ‘less’ (which is derived from *faa* ‘loss’). Numerals such as 16 – 19, 26 – 29, 36 – 39, 46 – 49, 56 – 59, etc are derived via the subtraction method.

- | | | |
|-----|-------------------|----------------|
| 21. | íní fá sí | ‘sixteen’ |
| | four less twenty | |
| 22. | tẹrẹ fá só | ‘twenty seven’ |
| | three less thirty | |
| 23. | mmeẹ fá mme sí | ‘thirty eight’ |
| | two less forty | |
| 24. | ngiẹ fá tẹsí | ‘fifty nine’ |
| | one less sixty | |

All three arithmetic methods of addition, multiplication and subtraction can be employed in the derivation of a numeral. For instance,

25. ngiẹ fá mme sí óyí fíndí ‘forty nine’
one less two twenty ten over

3. Ordinal Numerals

Apart from the first ordinal numeral *tárí*, all others are derived through a combination of a cardinal numeral and a verb root *káráamá* meaning ‘be complete’. Like the cardinals, ordinals also function as prenominal modifiers.

26. <i>tárí</i>	‘first’	<i>tárí tųwọ</i>	‘first child’
27. <i>mmeẹ káráamá</i>	‘second’	<i>mmeẹ káráamá tųwọ</i>	‘second child’
28. <i>tẹrẹ káráamá</i>	‘third’	<i>tẹrẹ káráamá tųwọ</i>	‘third child’
29. <i>íní káráamá</i>	‘fourth’	<i>íní káráamá tųwọ</i>	‘fourth child’
30. <i>sónọ káráamá</i>	‘fifth’	<i>sónọ káráamá tųwọ</i>	‘fifth child’

4. Conclusion

As earlier mentioned, there are some inconsistencies in Fom̃bọ (1975) and Bẹrẹsiri (2001) that this paper seeks to clarify. Fom̃bọ (1975) uses *na* ‘and’ for numbers 181 – 189. Elsewhere, he uses *fíndí*. Bẹrẹsiri (2001) uses *fíndí* for numbers 11 – 16, 21 – 26, 31 – 35, 41 – 49, 51 – 56, 61 – 69, 71 – 75, 81 – 85 and 96 – 99. The numbers for which *fíndí* is used is not consistent. This paper recommends that:

- fíndí* be used in deriving numbers 11 – 14, 21 – 25, 31 – 35, 41 – 45, 51 – 55, 61 – 65, 71 – 75, 81 – 85 and 91 – 95. This derivation also applies to larger numerals.
- fa* should be used in deriving numbers 16 – 19, 26 – 29, 36 – 39, 46 – 49, 56 – 59, 66 – 69, 76 – 79, 86 – 89 and 96 – 99. Again, this derivation applies to larger numerals.

Based on these recommendations, the numbers 1 – 100 are hereby listed.

31. <i>ngiẹ</i>	1	<i>óyí mmeẹ fíndí</i>	12
<i>mmeẹ</i>	2	<i>óyí tẹrẹ fíndí</i>	13
<i>tẹrẹ</i>	3	<i>óyí íní fíndí</i>	14
<i>íní</i>	4	<i>jeẹ</i>	15
<i>sónọ</i>	5	<i>íní fa sí</i>	16
<i>sóníé</i>	6	<i>tẹrẹ fa sí</i>	17
<i>sónọma</i>	7	<i>mmeẹ fa sí</i>	18
<i>íníne</i>	8	<i>ngiẹ fa sí</i>	19
<i>éséníé</i>	9	<i>sí</i>	20
<i>atié</i>	10	<i>sí ngiẹ fíndí</i>	21
<i>óyí ngiẹ fíndí</i>	11	<i>sí mmeẹ fíndí</i>	22

sí tẹrẹ fíndí	23	tẹrẹ fa tẹsí	57
sí íní fíndí	24	mmeẹ fa tẹsí	58
sí sọ̀nọ́ fíndí	25	ngiẹ fa tẹsí	59
íní fa só	26	tẹsí	60
tẹrẹ fa só	27	tẹsí ngiẹ fíndí	61
mmeẹ fa só	28	tẹsí mmeẹ fíndí	62
ngiẹ fa só	29	tẹsí tẹrẹ fíndí	63
só	30	tẹsí íní fíndí	64
só ngiẹ fíndí	31	tẹsí sọ̀nọ́ fíndí	65
só mmeẹ fíndí	32	íní fa tẹsí óyí fíndí	66
só tẹrẹ fíndí	33	tẹrẹ fa tẹsí óyí fíndí	67
só íní fíndí	34	mmeẹ fa tẹsí óyí fíndí	68
só sọ̀nọ́ fíndí	35	ngiẹ fa tẹsí óyí fíndí	69
íní fa mmeẹ sí	36	tẹsí óyí fíndí	70
tẹrẹ fa mmeẹ sí	37	tẹsí óyí ngiẹ fíndí	71
mmeẹ fa mmeẹ sí	38	tẹsí óyí mmeẹ fíndí	72
ngiẹ fa mmeẹ sí	39	tẹsí óyí tẹrẹ fíndí	73
mmeẹ sí	40	tẹsí óyí íní fíndí	74
mmeẹ sí ngiẹ fíndí	41	tẹsí óyí sọ̀nọ́ fíndí	75
mmeẹ sí mmeẹ fíndí	42	íní fa íníá sí	76
mmeẹ sí tẹrẹ fíndí	43	tẹrẹ fa íníá sí	77
mmeẹ sí íní fíndí	44	mmeẹ fa íníá sí	78
mmeẹ sí sọ̀nọ́ fíndí	45	ngiẹ fa íníá sí	79
íní fa mmeẹ sí óyí fíndí	46	íníá sí	80
tẹrẹ fa mmeẹ sí óyí fíndí	47	íníá sí ngiẹ fíndí	81
mmeẹ fa mmeẹ sí óyí fíndí	48	íníá sí mmeẹ fíndí	82
ngiẹ fa mmeẹ sí óyí fíndí	49	íníá sí tẹrẹ fíndí	83
mmeẹ sí óyí fíndí	50	íníá sí íní fíndí	84
mmeẹ sí óyí ngiẹ fíndí	51	íníá sí sọ̀nọ́ fíndí	85
mmeẹ sí óyí mmeẹ fíndí	52	íní fa íníá sí óyí fíndí	86
mmeẹ sí óyí tẹrẹ fíndí	53	tẹrẹ fa íníá sí óyí fíndí	87
mmeẹ sí óyí íní fíndí	54	mmeẹ fa íníá sí óyí fíndí	88
mmeẹ sí óyí sọ̀nọ́ fíndí	55	ngiẹ fa íníá sí óyí fíndí	89
íní fa tẹsí	56	íníá sí óyí fíndí	90

íníá sí óyí ngiẹ fíndí	91	íní fa sọnọá sí	96
íníá sí óyí mmeẹ fíndí	92	tẹrẹ fa sọnọá sí	97
íníá sí óyí tẹrẹ fíndí	93	mmeẹ fa sọnọá sí	98
íníá sí óyí íní fíndí	94	ngiẹ fa sọnọá sí	99
íníá sí óyí sọnọ fíndí	95	sọnọá sí	100

Notes

¹Numbers higher than *ńdẹẹ* ‘four hundred’ such as 500, 600 and 700 are derived by adding 100, 200 and 300 respectively to 400. This gives *ńdẹẹ sọnọá sí fíndí* for 500 and so on.

²The form for ‘sixty’ (*tẹsĩ*) is the only example of the morphological process of blending in the Iḡani numeral system.

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A Linguistic Analysis of the Structure of the Yoruba Counting System

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This paper analyzes the pattern of counting system of the Yoruba language (both the ordinals and the cardinals). It explains the technicalities of its arithmetical involvements which appear to have been contributing to the difficulty often encountered in its learning. The work throws more light on the crucial roles of some affixes in realizing some odd numbers, multiples of twenty, centenary, bicentenary, etc., in their order of increase. The paper goes much further to examine the linguistic structure of numerals in a bid to bring to limelight some salient linguistic features that are of significant interest to the teaching of the grammar of the language. Here, we discover that Yoruba numerals derive more of their formation from different aspects of the language structure like sound level (phonology), form/structure level (morphology and syntax), and meaning level (semantics) as evidenced in instances like deletion, assimilation, coalescence, tonal changes, tonal sandhi, ambiguity, affixation, linguistic typology to mention a few. We also discover that unlike in English, the direction of counting in Yoruba is done from right-to-left. Not only this, it adopts base five, decimal (base ten) and vigesimal systems of counting. We therefore hope that the detail analysis given in this work will not only fill a gap in the study of the Yoruba language in particular, but will also lead to the expansion of Yoruba linguistic database in general. We therefore admit the views of the scholars that linguistic documentation such as this is necessary not only for the study of the language, but only for the record-keeping of its norm and values which are fast giving way for the impact of technology and domineering influence of some world languages.

1. Introduction

In this paper, we are try to make the speakers of the Yoruba language, especially the young generation of the speakers to be conversant with numerals in the language, such that they would be better informed of its nitty-gritty. The work sees counting system as a product of human intelligence and open-endedness of his capacity for indepth thoughtfulness. Counting is an indispensable part of man. Whether consciously or unconsciously, counting is what we do each day. In the market (during price haggling), in the farm (during yam storage), in offices and even in our homes, or wherever while taking stock of some items. In fact, counting has been part of man right from creation. Biblically, it is recorded somewhere in the Book of Proverbs that may God teach us to count our days so that we might put our minds in the path of wisdom. It is very shameful if we can count do counting in other languages like Arabic and English without a slightest knowledge of how it is obtained in our native language. It could be embarrassing. It is so shameful if we can express ourselves in our languages to some point and suddenly switch over to the English language in expressing the numerals in the conversation.

Numeral in whatever language and in whichever forms/patterns it takes is a clear manifestation of the ability of man to manipulate his linguistic resources to cater for

his communicative needs. Numerals appear an aspect of language study which researchers, scholars and linguists pay less attention to. This neglect could be connected to certain impression that there is little or nothing else to say about it. Little did we know that there is much to say about this 'little'. Part of our linguistic knowledge is contained in the ability to express our ideas in our mother tongues. Our linguistic knowledge remains insufficient if we are unable to count fluently, analyze how the counting is done, and understand manipulations therein.

A work such as this could be said to fall, to a large extent, within the domain of language documentation. It is more or less a new field of study especially in Linguistics in recent time as captured by Woodbury (2003) that this new area is preoccupied with the making and keeping of records of significant features of the world's languages and their pattern of use. The foregoing has invariably given a clear-cut distinction between linguistic documentation and usual linguistic description. According to Himmelmann (1998), one of the ultimate aims of language documentation is the production of a detailed and comprehensive record of the linguistic practices peculiar of a given speech community. He further clarifies the 'practices' as both noticeable linguistic behaviour often made manifest in the speech act of members of the speech community, and the native speakers' metalinguistic intuition that enables them to provide interpretations and systematizations for linguistic units and events.

If indeed an education policy, the *Nigerian Policy on Education – NPE* (1977, revised severally up till 2004) which demand that every Nigerian child should be taught all subjects including mathematics in his/her own mother tongue at the early stage of his education is to be accomplished, the need for a thorough understanding of the counting system in our local indigenous languages becomes imperative, especially for the teaching of the number-related subjects.

So, this paper is unique in some ways especially for its mnemonic capacity in the face of the challenges of the 21st century when we have lost most of our traditional education for lack of written record couple with the domineering influence of the English language over the Nigerian languages. The need for this paper derives its strength from the observation of Woodbury (2003) that most of the traditional norms, values and attributes (like counting system) of African languages are fast fading away. Oyebade (2010) notes that language documentation (in whichever form) could be said to have a close affinity with the languages threatened by extinction. The knowledge of numerals will not only keep our competence in perspective, it will equally serve as a valuable asset in language pedagogy, historical linguistics, the comparative study of African languages and computational linguistics. It seeks to fill a gap in the linguistic study of Yoruba. The work will indeed increase the linguistic database available in the language. The paper does not only look at the technicalities of Yoruba numerals, it further analyzes the linguistic structure of it for the purpose of the enhancement of the teaching and learning of the language. The foregoing justifies Everett (2003) submission on the need to make permanent some significant features of African Linguistics especially her counting system for its theoretical insights to the body of language study. For it will be a colossal loss if it is allowed to be choked up by the thorns of the national, regional and world languages.

2. Yoruba Counting System: An Overview

The counting system will be done under certain headings in consonance with how things are classified and positioned, i.e. cardinal and ordinal numbers. Cardinal is a term used for the grammatical description referring to the class of numerals like one, two, three etc while ordinal is used to refer to the class of numerals like first, second, third etc. According to Oyebade (2010), numeral system in most African languages is based on either five, decimal (base ten), or vigesimal (base twenty). For instance, Nupe and Ebira use base five system of counting, Igbo and Esan adopts a decimal system. Yoruba adopts base five, decimal (base ten) and vigesimal counting systems. This according to Oduyoye (1969) is exemplified in the habitual counting of fingers in 5, 10 and the toes totaling 20.

Arabic	The counting pattern	Cardinals	Ordinals
1	ení/oókan	iwé kan (one book)	ipò kinní= í/èkinní
2	èjì/eéjì	„ méjì(two books)	„ kejì = í/èkejì
3	èta/eéta	„ mēta	„ kēta = í/èkēta
4	èrin/eérin	„ mērin	„ kērin= í/èkērin
5	árùn/aárùn-ún	„ márùn-ún	„ karùn-ún=í/èkarùn-ún
6	èfà/eéfà	„ mēfà	„ kefà = í/èkefà
7	èje/eéje	„ méje	„ keje= í/èkeje
8	èjọ/eéjọ	„ méjọ	„ kejọ = í/èkejọ
9	èsàn/eèsàn-án	„ mēsàn-án	„ kēsàn-án=í/èkēsàn-án
10	èwá/eéwàá	„ mēwàá	„ kēwàá=í/èkēwàá
11=10 + 1	òkànlá/òókànlá	„ mókànlá	„ kòkànlá=í/èkòkànlá
12=10 + 2	èjílá/eéjílá	„ méjílá	„ kejílá=í/èkejílá
13=10 + 3	ètálá/eéètálá	„ mētálá	„ kètálá=í/èkètálá
14=10 + 4	èrìnlá/eéèrìnlá	„ mērìnlá	„ kètálá=í/èkètálá
15=20 – 5	àrùndínlógún/aárùndínlógún	„ mēèdógún	„ karùndínlógún=í/ èkarùndínlógún
16=20 - 4	èrìndínlógún/eéèrìndínlógún	„ mēèrìndínlógún	kērìndínlógún= í/èkērìndínlógún
17=20 – 3	ètàdínlógún/eéètàdínlógún	„ mētàdínlógún	kètàdínlógún=í/èkètàdínlógún
18=20 – 2	èjìdínlógún/eéjìdínlógún	„ méjìdínlógún	„ kejìdínlógún=í/èkejìdínlógún
19=20 – 1	òkàndínlógún/oókàndínlógún	mókàndínlógún	kòkàndínlógún=í/ èkòkàndínlógún
20=10+10	ogún/okòó	„ ogún/ogún iwé	ipò ogún

3. The Yoruba Counting Techniques

If we observe closely, we would discover that 6, 7, 8, 9, and 30, 300, 400 (though not in the sample above, but in the subsequent analysis) are not used recurrently for the derivation of higher numbers. There are conventional terms used to designate ‘lesser than’ and ‘more than’. For instance, ‘ó dín.../dín ní...’ (it reduces/reduces) is used to count from 15 ‘mēèdógún’ (i.e. mú-árùn-d-n-ogún meaning *twenty lesser than five*) to 19 ‘mókàndínlógún’ (i.e. mú-òkan-dín-ní-ogún meaning *twenty lesser than one*). Note that the Yoruba meaning given here are in cardinals. 20 is counted ‘ogun’. Besides, ‘lé n...’ (increase by...) is from 1-4 while ‘ó dín ní...’ (decrease by) is from 5 – 9. The number of increase we count after the previous tens is 4. In other words,

from any number higher than ten, we shall add the first four units to the previous decimal and subtract the next five from the subsequent decimal number, as in:

11 to 14
21 to 24
31 to 34 and so on, we add 1 to 4

while the number of decrease we count before another tens is 5, as in:

15 to 19
25 to 29
35 to 39 and so on.

And the meaning of ten is not seen in twenty. From 21 to 24, the counting pattern changes from what is observed from 11 to 14. The numbers 11 through 14 are counted in the pattern given in the table above and 21 to 24 are counted as *mòkànlélogún* (i.e. *mù-òkan-lé-ní-ogún* meaning *take one more over twenty*), *méjilélogún* (i.e. *mù-èjì-lé-ní-ogún* meaning *take two more over twenty*), *mètàlélogún* (i.e. *mù-èta-lé-ní-ogún* meaning *take three more over twenty*) and *mérinlélogún* (i.e. *mù-èrin-lé-ní-ogún* meaning *take four more over twenty*) respectively. Apparently, the meanings of the counting from 21 to 24 are not difficult to decipher like numbers 11-12 (see the analysis in section 4.4). From 25 the counting is ‘... *dín lógbòn*’ (... *less than thirty*) which means that 25 is ‘*márùn-ún-dín-ní-ogbòn/mèdèdògbòn*’ meaning (*five lesser than thirty*) up to 29 ‘*mòkàndínlógbòn*’ meaning (*one lesser than thirty*). 30 is *ogbòn*. The same procedure is followed in the counting from 31 to 50. ‘*ogbòn*’ as we can note has no semantic connection with either twenty or forty but 40 has. In fact from number 40 henceforth, we start noticing some semantic import of some previous numbers and more importantly, the significance of arithmetic concepts such as division, multiplication, subtraction, addition. 40 is coded *ogoji*. It means:

$$(a) \quad \begin{array}{ccccc} 20 & \times & 2 & = & 40 \\ \text{ogún} & & \text{méjì/èjì} & & \text{ogóji/ogún-méjì.} \end{array}$$

From 50 ‘*àádòta*’ to 190 ‘*àádòwàá*’, the use of prefix ‘*àádò-...*’ is used to imply ‘*dín mèwàá*’ (–10) as against Jeje (1979) who says it is from 50 to 180, as shown below:

$$(b) \quad \begin{array}{ccccc} 50 & = & 60 & - & 10 \\ \text{àádòta (60 - 10)} & & \text{ogòta/ogún mèta} & & \text{èwá} \\ & & (20 \times 3) & & \end{array}$$

$$(c) \quad \begin{array}{ccccc} 70 & = & 80 & - & 10 \\ \text{àádòrin (80 - 10)} & & \text{ogórin/ogún mérin} & & \text{èwá} \\ & & (20 \times 4) & & \end{array}$$

$$(d) \quad \begin{array}{ccccc} 90 & = & 100 & - & 10 \\ \text{àádórùn-ún}(100 - 10) & & \text{ogórùn-ún/ogún} & \text{márùn-ún} & (\text{èwá}) \end{array}$$

The prefix ogó-/ogó- (i.e. divisible by 20) are used to show figures which are divisible by twenty like;

$$(e) \quad \begin{array}{ccccc} 40 & \div & 20 & = & 2 \\ \text{ogójì/ogún méjì} & & \text{ogún} & & \text{èjì} \end{array} \quad (\text{i.e. 40 is divisible by 20 twice})$$

$$(f) \quad \begin{array}{ccccc} 60 & \div & 20 & = & 3 \\ \text{ogóta/ogún méta} & & \text{ogún} & & \text{èta} \end{array} \quad (\text{i.e. 60 is divisible by 20 three times})$$

$$(g) \quad \begin{array}{ccccc} 80 & \div & 20 & = & 4 \\ \text{Ogòrin/ogún mèrin} & & \text{ogún} & & \text{mèrin} \end{array} \quad (\text{i.e. 80 is divisible by 20 four times})$$

Whatever ogó-/ogó- or àádó- is affixed to can equally be more or less as in:

$$(h) \quad \begin{array}{ll} 41 \text{ 'mókànlélógójì'} & (\text{forty increases by one}) \\ 42 \text{ 'méjìlélógójì'} & (\text{forty increases by two}) \\ 45 \text{ 'márùndínláàdóta'} & (\text{fifty decreases by five}) \\ 46 \text{ 'mèrìndínláàdóta'} & (\text{fifty decreases by four}) \end{array}$$

ogówàá/ogún mēwàá (20 x 10) means 200. It is conventionally coded 'igba'. From (200) above, 20 is no longer expressed as *ogún* as noted above but as *okòó* as seen in the examples below:

$$(i) \quad \begin{array}{lll} 220 \text{ 'okòólénígba/okòóléérúgba'} & (\text{twenty more than 200}) & \\ 280 \text{ 'okòódínlòdúnrún'} & (\text{twenty lesser than 300}) & \text{'300 is òdúnrún'} \\ 420 \text{ 'okòólénìrinwó'} & (\text{twenty more than 400}) & \text{'400 is irinwó'} \\ 480 \text{ 'okòódínlèdègbèta'} & (\text{twenty lesser than 500}) & \text{'500 is èdègbèta'} \end{array}$$

From 500 a new pattern that replaces 10 and 20 with 100 and 200 respectively as computation bases begins. From 500 we change the pattern of counting by prefixing 'èdègbè...' to any number that is less by 100. This shows that centuries larger than 200 is derived by either subtracting 100 from the next bicentenary or by multiplying 200 by the appropriate unit as given in the examples below:

$$(j) \quad \begin{array}{ccccc} 600 & - & 100 & = & 500 \\ \text{ègbèta/ igba méta} & & \text{ogórùn-ún/ogún} & \text{márùn-ún} & \text{èdègbèta} \\ (200 \times 3) & & (20 \times 5) & & (600 - 100) \end{array}$$

$$(k) \quad \begin{array}{ccccc} 800 & - & 100 & = & 700 \\ \text{ègbèrin/igba mèrin} & & \text{ogórùn-ún/ogún} & \text{márùn-ún} & \text{èdègbèrin} \\ (200 \times 4) & & (20 \times 5) & & (800 - 100) \end{array}$$

(l)	1000	--	100	=	900
	ẹgbẹ̀rún/igba márùn-ún		ogórùn-ún		ẹ̀ẹ̀dẹ̀gbẹ̀rún
	(200 x 5)		(20 x 5)		(1000 – 100)

Whereas ‘ẹ̀ẹ̀dẹ̀gbẹ̀...’ is less by 100, ‘ẹgbẹ̀...’ is affixed to any number that is divisible by 200 thus:

(m)	600	÷	200	=	3
	ẹgbẹ̀ta/igba mẹ̀ta		igba		ẹ̀ta

(n)	800	÷	200	=	4
	ẹgbẹ̀rin/igba mẹ̀rin		igba		ẹ̀rin/mẹ̀rin

(o)	1000	÷	200	=	5
	ẹgbẹ̀rún/igba márùn-ún		igba		márùn-ún

As observed in ogó-/ogó- and àádó-, whatever ẹ̀ẹ̀dẹ̀gbẹ̀ – and ẹgbẹ̀- are attached to can equally decrease or increase as shown below:

(p)	502 ‘ẹ̀jì-lẹ̀-ní-ẹ̀ẹ̀dẹ̀gbẹ̀ta’
	540 ‘òjì-lẹ̀-ní-ẹ̀ẹ̀dẹ̀gbẹ̀ta’
	620 ‘okòó-lẹ̀-ní-ẹgbẹ̀ta’
	860 ‘òtà-lẹ̀-lẹ̀gbẹ̀rin/òjì-dín-lẹ̀dẹ̀gbẹ̀rin’
	955 ‘àrùn-dín-lẹ̀gbẹ̀rún’

The secret behind the Yoruba numerals especially at this point is that: we can use 2000 ‘ẹgbàwá/ẹgbàá-’ i.e. igba mewaá (200 x 10) as a prefix attached to describe any figure that is divisible by 2000 thus:

(q)	4000	÷	2000	=	2
	ẹgbàájì/ẹgbàá méjì		ẹgbàá		méjì

(r)	6000	÷	2000	=	3
	ẹgbàáta/ẹgbàá mẹ̀ta		ẹgbàá		mẹ̀ta

(s)	8000	÷	2000	=	4
	ẹgbàárin/ẹgbàá mẹ̀rin		ẹgbàá		mẹ̀rin

(t)	10,000	÷	2000	=	5
	ẹgbàárùn-ún/ẹgbàá márùn-ún		ẹgbàájì		márùn-ún

If the number too is equally less by 1000, we attach ‘ẹ̀ẹ̀dẹ̀gbàá-’ as shown below:

(u)	3000	=	4000	–	1000	or	200	x	15
	ẹ̀ẹ̀dẹ̀gbàájì/ẹgbẹ̀dogún		ẹgbàájì		ẹgbẹ̀rún		igba		mẹ̀dẹ̀dogún

(v)	5000	=	6000	-	1000	or	200	x	25
	ẹ̀ẹ̀dẹgbààta/ẹgbẹ̀ẹ̀dọ̀gbọ̀n		ẹgbàata		ẹgbẹ̀rún		igba		mẹ̀ẹ̀dọ̀gbọ̀n
(w)	7000	=	8000	-	1000	or	200	x	35
	ẹ̀ẹ̀dẹgbààrin		ẹgbààrin		ẹgbẹ̀rún		igba		márùndínlógóji
(x)	9000	=	10000	-	1000	or	200	x	45
	ẹ̀ẹ̀dẹgbààrùn-		ẹgbààrùn-ún		ẹgbẹ̀rún		igba		márùn-úndínláàdọta

The data provided in section 2 and 3 above reveal that Yoruba adopts both decimal (1 to 10) and vigesimal (multiples of 20 to 200) system of counting. Besides, from the mathematical analysis in section 3, it is evident that Yoruba computes from right-to-left as against English which computes from left-to-right as typified by the common Hundreds Tens and Unit). An Oyebade (2010) note that, to a large extent, Yoruba numeral is anticipatory since subtraction is done in the anticipation of the next decimal or centennial number. Yoruba operates subtraction in a base five system and this is done at each decimal junction.

Suffice it to say here that the difficulties and the consequent discouragement that greet the learning and usage of the counting system in Yoruba may not have been unconnected with the mathematical applications therein and the correct use and interpretation of the affixes like *àádọ-*, *ogó-/ogó-*, *ẹ̀ẹ̀dẹ-*, *ẹ̀ẹ̀dẹgbẹ-*, *ẹgbẹ-*, *ẹgbẹ̀ẹ̀dẹgb-*, etc. Even the use of base five as a computing strategy for decimals with the sequence reversed equally contributes in some way to its frustrating nature. This observation is aptly captured by Awobuluyi (1994) that the derivation of numerals in most African languages is quite tiresome and complicated.

4. The Linguistic Analysis of the Yoruba Numerals

The structure of any language is amenable to three different levels viz, sound level (phonology), form/structure level (morphology and syntax) and meaning level (semantics). There are issues of linguistic interest in the numerals of the Yoruba language whose analysis will give are lots of insights about the counting system in the language. These issues will further enhance the teaching and learning of the Yoruba language and its comparison with some other languages.

4.1 Phonological Structure

Phonology is a distinct aspect of language study because of its centrality of the development of any language right from its orthography design to its reconstruction.

There are some salient phonological observations which are of significant interest in the counting system of Yoruba. These observations can only be explained via the analysis of its linguistic structure. Some of these issues are phonological processes like deletion (segment and suprasegment), assimilation, coalescence, denasalization and even free variation (phoneme identification).

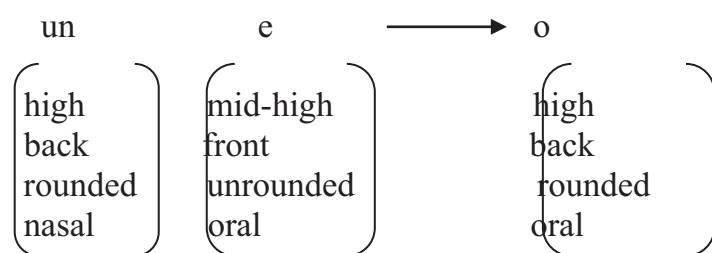
Coalescence

This is a phonological process where two segments merge together to produce an entirely new segment distinct from the input. Coalescence is a term used in linguistics to refer to the coming together of linguistic units which were originally distinguishable. Bamgbose (1990) defines vowel coalescence as a combination of two contiguous (underlying) vowels whose output is a different vowel entirely. For example,

(i) Ogún + èjì = ogójì
 twenty two forty

(ii) Ogún + èta = ọgóta
 twenty three sixty

In the examples above, the underlined segments at the underlying level (nasalized and oral vowels) merge together to produce the oral vowels underlined at the surface level. Awobuluyi (1983, 1987) refers to this type of coalescence as coalescence by assimilation with the skeletal format below:



Deletion

Oyebade (2010) notes that deletion is one of the most obvious phonological processes in language. He notes that the process in Yoruba come about as a result of Yoruba preference for the shape and constitution of words. It is a term used to refer to the omission of sounds in connected speech. Both vowels and consonants may be affected.

(A) Consonant deletion

- (i) Irin owo → irin_wo → irino
- (ii) mẹ̀rìnlá → mẹ̀ìnlá
- (iii) ọ̀ọ́dúnrún → ọ̀ọ́dún

The above example (i) shows that consonant [w] was deleted amidst two vowels since the two vowels are rounded according to Oyebade (2010). Though there is an instance of vowel deletion too. In the example (ii), the consonant r is deleted, now at the beginning of the word unlike the assumption that it is usually in the last syllable of the

word as in the example (iii) where consonant *r* is deleted in the last syllable (in fact the entire last syllable is deleted).

(B) Vowel deletion

$$\begin{array}{ccc} \text{ogó-} & + & \text{òrún} & \longrightarrow & \text{ogórùn-ún} \\ 20 & \times & 5 & & 100 \\ \text{(semantically)} & & & & \end{array}$$

The deletion here is predictable; the vowel of the prefix is elided and its floating high tone displaces the low tone on the adjacent vowel *ò* and got docked to it.

$$\begin{array}{l} 16 = \text{mèrìndínlógún} \rightarrow \text{mẹ̀ìndínlógún} \\ 24 = \text{merinlelogun} \rightarrow \text{mẹ̀ìnlélógún} \\ \text{mú} + \text{èjì} = \text{mẹ̀jì} \text{ 'two'} \\ \text{mú} + \text{ẹ̀ta} = \text{mẹ̀ta} \text{ 'three'} \end{array}$$

It would be observed in the examples above that a consonant segment */r/* is deleted in the first two examples while a vowel sound */u/* is elided to derive unit forms of the numerals. The elision of sound may have been borne out of desire to ensure easy production of speech.

Tonal Sandhi

Sequence of adjacent tones may influence each other phonetically or phonologically. In other words, a word which in isolation would have low tone may be given a higher tone if a high-tone word follows. This phenomenon, according to Crystal (2003) is referred to as tonal sandhi. Example of this is seen below

$$\text{Mú ọkan lé ní ogún} \rightarrow \text{mọ̀kànlélógóún}$$

Tonal changes

There is no definite order for the occurrence of tone in Yoruba. Oyebade notes that tones occur indiscriminately. The pattern of tonal changes observed in the Yoruba counting system deserves some attention. It would be noted that cardinal numbers in the language (apart from *kan* 'one') start with high tones while ordinal numbers begin with low tones as shown in the table above.

Cardinal numbers	Ordinal numbers
mẹ̀jì	ì/ẹ̀kejì
mẹ̀tá	ì/ẹ̀kẹta
márùn-ún	ì/ẹ̀karùn-ún

Denasalization

Denasalization can be defined as the loss of underlying present nasality at the phonetic level. Awobuluyi and Oyebade (1995) note that many phonologists are of the opinion that nasalization is common and more natural than denasalization. As such, they tend

- | | | | | |
|------|--------|---------|---|-------|
| (i) | | ìkíníní | } | one |
| | /i, e/ | èkíníní | | |
| (ii) | | ìkẹ̀ta | } | three |
| | /i, e/ | ẹ̀kẹ̀ta | | |

4.2 Morphological Structure

Clipping

This is a morphological process whereby a word is shortened. The reduction could be at any part of the word such as the middle, as in the examples below;

11 = Oókànlélẹwàá	=	oókànlá	‘one more than ten’
12 = Méjilélẹwàá	=	méjilá	‘two more than ten’
13 = Mètàlélẹwàá	=	mètálá	‘three more than ten’

Prefixation

We observe that affixes (bound morphemes) play some crucial role in the counting system of the Yoruba language. Two types of affixes are attested to in Yoruba. These are prefixes and interfixes. Prefixes feature prominently in signaling increase by or decrease by of certain number. Some examples are given below:

- (i) ‘àádọ-’, as in:
 $\begin{array}{l} \text{àádọ-} + \text{ọta} \\ -10 \quad (20 \times 3) \\ 60 - 10 = 50 \end{array} = \begin{array}{l} \text{àádọ- ọta} \\ \text{‘fifty’} \end{array}$
- (ii) àádọ- + ọrìn = àádọrìn ‘seventy’
 $\begin{array}{l} -10 \quad (20 \times 4) \\ 80 - 10 = 70 \end{array}$
- (iii) ‘Ogó-/ogó-’, as in:
 $\begin{array}{l} \text{Ogó-} + \text{ẹje} \\ 20 \times 7 \end{array} = \begin{array}{l} \text{ogóje} \\ 140 \end{array}$
- (iv) ogó- + ẹfà = ogófà
 $20 \times 6 = 120$
- (v) ‘ẹgbẹ-’, as in:
 $\begin{array}{l} \text{ẹgbẹ-} + \text{ẹfà} \\ 200 \times 6 \end{array} = \begin{array}{l} \text{ẹgbẹfà} \\ 600 \end{array}$
- (vi) ‘ẹẹdẹgbẹ-’ as in:
 $\begin{array}{l} \text{ẹẹdẹgbẹ-} + \text{ẹgbẹjo} \\ -100 \quad (200 \times 8) \\ 1600 - 100 = 1500 \end{array}$
- (vii) ìk- + ẹta = ìkẹta
 Ordinal marker three third (positional numeral)
- (viii) ìk- + ẹfà = ìkẹfà
 Ordinal marker six sixth (positional numeral)

Language typology

A pocket of examples so far can testify to the fact that the Yoruba language, to a large extent is an agglutinative language according to August Schlegel' 1818 morphological classification of languages. This is justified by the fact that morphemes combined in the sentential derivation are separable and they retain their distinct meanings. For instance;

(i) 17 = Mú òkan dín ní ogún
Take one less in twenty

(ii) 34 = Mú èrin lé n ogbòn
Take four more in thirty

4.3 Syntactic structure

There are examples of numerals performing the function of attributive position. However, the adjectives are known to occur after the noun which they modifying in the Yoruba language unlike the English language where they occur before the noun as shown below:

ìwé ogún ni mo rà	'I bought twenty books'
ilé ogbòn ni mo kó	'I built thirty houses'

But there are counter-examples where the numeral adjectives are found before the noun they modify.

ogún ìwé ni mo rà	'It is twenty books that I bought'
ogbòn ilé ni mo kó	'it is thirty houses that I built'

4.4 Semantic structure

Almost all the numerals in Yoruba have meanings that can be analyzed on morphemic basis. However, there are some numerals whose meanings appear arbitrary; there is no direct connection between them and the figure they depict. They are assigned basic status. According to Oyebade (2010), Yoruba has 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 200 and 400 as basic elements. They are not formed from other numbers. The meanings of some of them may have been borne out of their monetary implication which requires an excursion into the diachronic analysis of the Yoruba naira and kobo monetary system. Examples of such numbers are;

200	=	igba
400	=	Irinwó
300	=	òdúnrún

Whereas irinwo (400) could be analyzed as;

Irin owó
Iron money

The intuitive knowledge of a native speaker of the language is required to show that *irinwó* means ‘a huge amount of money’. But 200 (*igba*) and 300 (*òṣódúnrún*) cannot be analyzed. Their meanings are basically conventional.

5. Summary of Findings and Conclusion

It is indeed a truism that every language is rule-governed. In this paper, we discover that numeral in Yoruba requires some arithmetic in a way that it stimulates our intelligence. This might be one of the reasons why many people are not so interest in its learning. Besides, it appeals to our competence consciousness to know which affix to be attached to what number while counting the numbers that are even and odd. The counting system in the language is from right-to-left. In addition, Yoruba uses base five, decimal, and vigesimal (base twenty) counting system. Moreover, the Yoruba language is arbitrary and conventional. Arbitrary in the sense that there are some numbers whose meanings have no connection of any sort with the arithmetical calculation that produce them. Their acceptance is conventional. However, a good percentage of the numbers have meanings that are conceptual in form and their understanding could be interesting.

In the analysis, we discover that there are a number of linguistic insights in the structure of Yoruba numerals. And these linguistic features enrich the linguistic database of the language and facilitate the teaching and learning of the grammar of the language.

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An Outline of the Hausa Numeral System

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Long contact with Arabic and English brought about some influence on the Hausa numeral system. The world ethnic groups are said to use a variety of different numeral systems; some of which are decimal systems, quaternary systems, ternary systems, binary systems and mixed systems. The present essay introduces the Hausa numeral system as it is today, and therefore asserts that the Hausa numeral system is adequate enough to cater for the counting needs of the Hausa society. The paper also traces the history of the numeracy before and after the Hausa contact with Arabic and English.

1. History of Numeracy in Hausa

The Hausa people occupy a vast land in the Central Sudan and lived in city-states before the Islamic reformation led by Othman Danfodiyo in 1804. The city-states were independent states, each with a king and a standing army. The states were consistently fighting one another, all in a bid for land expansion. The Hausas had been in their present location in the Central Sudan for over twenty thousand years. The Hausas developed a strong civilization with a refined numeral system. It is pertinent to note that trade and commerce, livestock production and extensive farming activities have all contributed to the development of a refined numeral system by the Hausa people.

2. Hausa Traditional Numeral System

The Hausa traditional numeral system uses **base ten** for counting. Thus, Hausa has basic numerals **one** to **ten** and subsequent numeration i.e. eleven upward, is achieved through the manipulation of the basic numerals one to ten. The basic numerals are as follows:

(1)

ɗáyá	one	shídà	six
bíyú	two	bákwài	seven
úkù	three	tákwàs	eight
húfú	four	tàrà	nine
bìyár	five	goómà	ten

It is important to note that Hausa, like all indigenous African languages, has no writing system of its own. It was only later contact with Arabic and English that allowed Hausa to be written using an Arabic based writing system called **àjàmí** and an English based writing system called **boókò**.

Attention is drawn to the symmetry in syllable structure and tone pattern of the basic numerals 1 to 10 in Hausa. Each of the basic numerals is a disyllabic word. Basic numerals 1, 2 and 4 all have high-high tone pattern (ɗáyá, bíyú, húfú). Basic numerals 3, 6, 7, 8, 9 and 10 all have high-low tone pattern (úkù, shídà, bákwài, tákwàs, tàrà, goómà). Basic numeral 5 stands alone with low-high tone pattern: bìyár.

Counting from 11 to 20 is achieved in Hausa through the addition of each of the basic numerals 1 - 9 to the basic numeral 10. Thus, eleven is *ten and one*. Twelve is *ten and two*, and so forth.

The word for ‘and’ in Hausa is **dà**, but in the numeration 11 – 19, Hausa uses the word **shàà** instead. The numerals 11 – 19 in Hausa are as follows:

(2)

11	goómà shàà dáyá	16	goómà shàà shídà
12	goómà shàà bíyú	17	goómà shàà bákwàì
13	goómà shàà úkù	18	goómà shàà tákwàs
14	goómà shàà húfú	19	goómà shàà tǎrà
15	goómà shàà biyár		

The numeral 20 (twenty) in Hausa is ‘two tens’ (i.e. goómà bíyú) and not ‘ten and ten’ (goómà dà goómà or *goómà shàà goómà). The numeral 21 (twenty one) is **goómà bíyú dà dáyá**. Let it be mentioned once again that **shàà** is used for ‘and’ only in numerals 11 – 19. From 21 – 99, **dà** is used throughout. Numerals 21 – 29 in Hausa are as follows:

(3)

21	goómà bíyú dà dáyá	26	goómà bíyú dà shídà
22	goómà bíyú dà bíyú	27	goómà bíyú dà bákwàì
23	goómà bíyú dà úkù	28	goómà bíyú dà tákwàs
24	goómà bíyú dà húfú	29	goómà bíyú dà tǎrà
25	goómà bíyú dà biyár		

The numeral 30 (thirty) is ‘three tens’ (= goómà úkù). The numeral 80 (eighty) is ‘eight tens’ (= goómà tákwàs). This pattern applies to the remaining numerals 40, 50, 60, 70 and 90. However, the numeral 100 (one hundred) is not ‘ten tens’ (= goómà goómà), but rather a single word **dàrií**.

The numeral 200 (two hundred) is however ‘two dàrií’ (= dàrií bíyú). Others are:

(4)

300	dàrií úkù	700	dàrií bákwàì
400	dàrií húfú	800	dàrií tákwàs
500	dàrií biyár	900	dàrií tǎrà
600	dàrií shídà		

Here again, the numeral 1000 (one thousand) is not ‘ten dàrií’ (= dàrií goómà) but rather a single word **dúbuú**. Thus, counting thousands in Hausa is achieved through the mentioning of the word **dúbuú** (thousand) first, then followed by the intended number of thousand(s). For example, ‘one thousand’ will be *dúbuú dáyá* (lit. ‘thousand one’). Other random examples are as follows:

(5)

2000	dúbuú bíyú
7000	dúbuú bákwàì
10,000	dúbuú goómà
11,000	dúbuú goómà sháà dáyá (lit. 'thousand eleven')
100,000	dúbuú d'arií (lit. 'thousand hundred')
400,000	dúbuú d'arií húfú (lit. 'thousand hundred four')

Hausa has the concept **dúbuú dúbuú** (lit. 'thousand thousand'), i.e. one thousand in one thousand places or one thousand times one thousand. This is referred to as **zámbar dúbuú**. However, Hausa does not have a single word for the figure. A single word for the figure in English is 'million'. Thus, Hausa borrowed the term 'million' from English to stand for its equivalent phrase *zámbar dúbuú*. The Hausanized form of 'million' is **mílíyàn**. Notice that *zámbar dúbuú* was used for *million* prior to Hausa-English contact.

4. Influence of Arabic on The Hausa Numeral System

It is a known fact that the Hausas and Arabs had a long standing contact through general trading and slavery. Later, the Arab traders brought the religion of Islam to Hausaland, and the association became both in trade and in religion. Thus, centuries of mutual contact brought about great impact of Arabic on Hausa. Several words of Arabic were borrowed and Hausanized. In the area of numeracy, there are significant borrowings from Arabic to Hausa. It will be recalled that Hausa has the following phrases for the numbers 20, 30, 40, 50 60, 70, 80 and 90:

(6)

20	goómà bíyú	60	goómà shídà
30	goómà úkù	70	goómà bákwàì
40	goómà húfú	80	goómà tákwàs
50	goómà bìyár	90	goómà tārà

The long contact between Hausa and Arabic led to the borrowing of Arabic single words for 20, 30, 40, 50, 60, 70 80 and 90 as in (7) below:

(7)

<i>Numerals</i>	<i>Arabic</i>	<i>Hausa</i>
20	ʔishruun	ishirín
30	thalaathuun	tàlàatín
40	arba'uun	àrbà'ín
50	khamsiin	hàmsín
60	sittuun	sittín
70	thaba'uun	sàbà'ín
80	thamaaniin	tàmàanín
90	tis'uun	càsà'ín

The numerals 21, 25, 26 and 29 for instance will now be stated as follows:

(8)

- 21 ìshìrín dà ɗáyá
- 25 ìshìrín dà bìyár
- 26 ìshìrín dà bákwaì
- 29 ìshìrín dà tara

The formula is ‘**twenty and -**’ where ‘-’ takes any numeral from 1 – 9. Thus, **ìshìrín dà ɗáyá** translates into ‘twenty and one’ (or twenty-one).

5. Influence of English on the Hausa Numeral System

The contact between Hausa and English had also been a long standing one. Initially, it was as a result of *discovery missions* when missionaries and trade missions came to Hausaland in search of information about the Hausa people. Later contact came as a result of British colonialism in Nigeria. At this point, it is important to note that the old independant Hausa states had been unified under the umbrella of the Sokoto Caliphate, and when Britain colonized the old Sokoto Caliphate, administration was much easier through what was known as *indirect rule*. The indirect rule was excellent in terms of general administration of the colonized area (i.e. old Sokoto Caliphate) but didn’t succeed much in making the colonial language, i.e. English, to make any impact on the populace. English was only encouraged in schools and that was not enough to influence the Hausa language in any remarkable degree.

It was mentioned earlier on that Hausa borrowed the English single word ‘million’ to replace its phrase *zámbàr dúbuú*, meaning ‘million’. However, Hausa borrowed from English both the term and concept ‘billion’. The Hausanized form of the word is **bilíyàn**.

6. The Hausa Numeral System Today

An important aspect of the numeral system of a language is the ability to use the numerals for addition, subtraction, multiplication and division purposes. Hausa allows its numerals to be used in all these ways.

Addition is referred to as **taáràawaá**; subtraction as **ɗeébèewaá**; division as **rábàawaá** and multiplication as **sàu** (or **nínkàawaá**). For example, the phrase ‘five plus three’ is *bìyár à taárà dà úkù* in Hausa. ‘Ten minus seven’ is *goómà à ɗeébè bákwaì*. ‘Three times two’ is *úkù sàu bìyú*, and ‘eighteen divided by six’ is *goómà shàà tákwàs à rábàa dà shidà*.

At this juncture, we draw attention to the different ways of stating multiplication and addition. In Hausa, figures involving addition carry the word **dà** which means ‘and’. Recall that **shàà** is used instead if the addition ranges between 11 (ten and one) and 19 (ten and nine).

Multiplication is left unmarked. That is to say, neither **dà** nor any other symbol for that matter is used. Thus, a figure such as *goómà bìyár* will translate ‘ten multiplied by five’. The total sum is therefore ‘fifty’ or the borrowed Arabic word

hàmsín. Now consider the figure 999,000. It is *dúbuú ðàrii tára dà càsà'ín dà tára*. Let us use bracketting for addition and multiplication purposes:

(9) *Dúbuú* [[*ðàrii tára*] *dà* [*càsà'ín dà tára*]]

The first inner bracket *ðàrii tára*] involves multiplication: $100 \times 9 = 900$. The second inner bracket [*càsà'ín dà tára*] involves addition: $90 + 9 = 99$. The outer bracket [*ðàrii tára dà càsà'ín dà tára*] involves addition: $900 + 99 = 999$. The initial word of (9) which is *dúbuú* plus the content of the outer bracket which is [*ðàrii tára dà càsà'ín dà tára*] involve multiplication: $1000 \times 999 = 999,000$.

Division is marked by the phrase *à rábàa dà*. This phrase, which marks division, is placed between the two numerals involved in division. Thus, 'twenty divided by five' translates into Hausa as *shirín à rábàa dà biyár*. As in English, in Hausa also, it is the first numeral that is divided into the number represented by the second numeral. Thus, in this example, it is 20 which is to be divided into 5 places.

Subtraction is marked by the phrase *à ðeébè*. This phrase, which marks subtraction, is placed between the two numerals involved in subtraction. Thus 'eighteen minus six' translates into Hausa as *goómà sháà tákwàs à ðeébè shídà*. As in English, in Hausa also, it is the second numeral (here 6) that is subtracted from the first numeral (here 18). Thus, 6 is subtracted from 18.

Fractions and decimals are also expressed in Hausa. One important fraction found in Hausa is *rábù* ('half'). If this is written as a numeral, i.e. $\frac{1}{2}$, it is called *rábù* or *ɗáyá bísà bíyú* (lit. 'one on top of two'). $\frac{1}{4}$ or 'a quarter' is *rúbù'ii* (from Arabic) or *kwátàa* (from English) or *ɗáyá bísà húdú* in Hausa. $\frac{1}{3}$ or 'one third' is *súlùsi* (from Arabic) or *ɗáyá bísà úkù* in Hausa. The general meaning of these fractions is that the number on top of the bar or slash is divided into the number beneath the bar or slash. Thus, $\frac{1}{2}$ means the number 1 on top of the slash is to be divided into 2 places. That will give 'half of one'. The concept is the same both in English and Hausa.

When fractions are decimalized, a fraction such as $\frac{1}{2}$ (half) will be written as 0.5 (i.e. point five). A fraction such as $1\frac{1}{2}$, is written in decimal form as 1.5 (one point five). In Hausa, this is *ɗáyá dà dígòo biyár* (lit. 'one and point five'). The decimal point is referred to as *ígòo* in Hausa.

7. Conclusion

The numeral system of Hausa is indeed quite comprehensive, and an average Hausa person is capable of using the numerals to express his numerical needs. Most languages in the world operate the base ten counting system and Hausa is one of them. This outline has shown that Hausa is quite receptive to numerical issues pertaining to fraction and decimalization. With respect to language endangerment, Comrie (2005) points out that 'numeral systems are even more endangered than languages'. Despite this observation, we still believe that Hausa numeral system will, for a time, survive the onslaught of endangerment brought about by the forces of globalization.

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The Numeral System of Ịzọn

God'spower Tamaraukuro Prezi

In this paper, we undertake an overview of the traditional, modern and 'standardized' counting system of Ịzọn from a descriptive perspective. We also look at the functions and values of the minor bundle *oyi* (10), the first major bundle *sí* (20), the second major bundle *andé* (400), and the the super bundle *andérìmandé* (160,000) in the numeral system. More especially, we examine how 400 came to be the highest number in the numeral system of Ịzọn, and how the Ịzọn arrive at high numbers like *andérìmandé*. We find that the Ịzọn use base-10 and base-20 in their numeral system, and count money traditionally in *akpa* (bags of 200).

1. Introduction

A numeral is a written sign or symbol that is used to represent a number. A numeral system or a number system is a set of symbols, characters and mathematical rules that are used as the bases for counting things, identifying or expressing the quantity/quantities of something, determining order or position, comparing amounts, performing calculations, and representing value (Lamb and Johnson, 2002. <http://42explore.com/number.htm>).

Some of the number systems in the world include the Arabic, Babylonian, Chinese, Egyptian, Greek, Mayan, and Roman number systems.

This paper takes a look at the numeral system of Ịzọn which is discussed under the following sub-headings:

- a. Traditional and modern counting systems in Ịzọn.
- b. Different ways of counting in Ịzọn.
- c. On the origin of 400 as the highest number in the numeral system of Ịzọn.
- d. Manipulating high numbers in the counting system of Ịzọn.
- e. On the relationship between the numeral system and other aspects of the grammar of Ịzọn.
- f. The endangerment of the numeral system of Ịzọn.
- g. Apparent mixture in the numeral base systems in Ịzọn.
- h. Standardisation and the loss of traditional counting system in Ịzọn
- i. Language engineering, numeracy and the implications for teaching science and technology in Ịzọn.

1.1 Different ways of counting in Ịzọn

The different ways of counting in Ịzọn include the traditional way of counting (see 1.1.1 above), the modern way of counting (see 1.1.2 above), and the standardized way of counting (see 1.8 below).

1.2 Traditional and modern counting systems in Ịzọn

The Ịzọn counting system has slight dialectal differences in few of the numbers which however are understood by most Ịzọn native speakers (see the numbers 1 to 10 in 1.1.1 and 1.1.2 below).

Evilewuru (2008: 52-56) observes that two important terms dominate the counting system: *feni/fini/foni* which means ‘remainder’ or ‘extra’ and *mọ/mụ* which is the conjunction ‘and’. Most numbers in the Iẓon counting system are made up of two parts: the counting bundle (called ‘*kịen pou*’), and an extra or remaining part to which the term *feni/fini/foni* is applied which is not up to another full or complete bundle. The counting bundles (*pou*) in Iẓon are *oyi* ‘ten’ (10), *sí* ‘twenty’ (20) and *andẹ/ondẹ* ‘four hundred’ (400).

Oyi is a minor counting bundle which is temporarily tied and performs only a hand-over function in the counting system of Iẓon. Any number less than *oyi* that is counted on top of *oyi* is regarded as a remainder or an extra denoted by *feni*, *fini* or *foni*. Thirteen, for example, is *oyi taáru feni* (which literally means ten and three extra).

Sí is the first major counting bundle. On reaching twenty while counting, the use of *oyi* ceases and the use of *sí*, the first major bundle, commences. For instance, twenty-nine (29) would be counted as *sí isé feni*: i.e. (a bundle of) twenty and nine extra. After *ma sí* (40), the use of *feni/fini/foni* to signify extra or remainder ceases, and the use of *mụ/mọ* takes over. Thus, forty-five is counted as *ma sí mọ sọ́nrọ́n mọ* (not **ma sí sọ́nrọ́n feni*).

Andẹ/ondẹ (400) is the second major bundle of counting in Iẓon. However, the ‘super-bundle’ of all counting in Iẓon is *andẹ́rimandẹ/ondẹ́rimondẹ* which is one hundred and sixty thousand (160,000), derived from 400 x 400.

1.2.1 Traditional counting system in Iẓon

a. Counting Numbers

Traditionally, the Iẓon people use to count numbers and other material things in ‘twenties’ (20s) and ‘four hundreds’ (400s). Traditionalists do not accept the use of *ma oyi* for 20, *tará oyi* for 30, *nía oyi* for 40, *sọ́nrọ́n oyi* for 50, *sondia oyi* for 60, *sọ́nọ́ma oyi* for 70, *niina oyi* for 80, *iséná oyi* for 90, *oyia oyi* for 100, etc. Instead, they use *sí* for 20, *ma sí* for 40, *tará sí* for 60, *nía sí* for 80, *sọ́nrọ́n sí* for 100, etc. Numbers are counted in the manner outlined below. Note that in Iẓon *feni* means ‘to remain’. In the counting system, literally, *feni* means ‘extra’ i.e. ‘surplus’.

Alternative words or phrases and/or tone markings for the same number are separated by slashes.

0. éyéfá/yéfaá
1. kẹ̀nì/kẹ̀nì
2. mamụ/mamụ/maamụ
3. taáru/táárú/tárú
4. nein/nóin/ni
5. sọ́nrọ́n/sọ́nrọ́n/sọ́nrọ́n/sọ́nrún
6. sondie/sóndié/seindie/síndió/sídíó
7. sọ́nọ́ma/sọ́nọ́ma
8. niina/nina/níngína/níngíni/níngíne
9. isé/esé/ísín
10. oyi/ói

-
11. oyi kẹnị feni (ten and one)
 12. oyi mamụ feni (ten and two)
 13. oyi taáru feni
 14. oyi nein feni
 15. oyi sọónrọn feni; (also, die)
 16. oyi sondie feni
 17. oyi sọnọma feni
 18. oyi niina feni
 19. oyi isé feni
 20. **sí/síí**
 21. sí kẹnị feni (twenty and one)
 22. sí mamụ feni
 23. sí taáru feni
 24. sí nein feni
 25. sí sọónrọn feni
 26. sí sondie feni
 27. sí sọnọma feni
 28. sí niina feni
 29. sí isé feni
 30. sí oyi feni
 31. sí oyi kẹnị feni
 32. sí oyi mamụ feni
 33. sí óyí taáru feni
 34. sí oyi nein feni
 35. sí oyi sọónrọn feni (also, si die féní)
 36. sí oyi sondie feni
 37. sí oyi sọnọma feni
 38. sí oyi niina feni
 39. sí oyi isé feni
 40. ma sí/maa sí (two twenties)
 41. ma sí mọ kẹnị mọ
 42. ma sí mọ mamụ mọ
 43. ma sí mọ taáru mọ
 44. ma sí mọ nein mọ
 45. ma sí mọ sọónrọn mọ
 46. ma sí mọ sondie mọ
 47. ma sí mọ sọnọma mọ
 48. ma sí mọ niina mọ
 49. ma sí mọ isé mọ
 50. ma sí mọ oyi mọ
 51. ma sí mọ oyi kẹnị feni mọ
 52. ma sí mọ oyi mamụ feni mọ
 53. ma sí mọ oyi taáru feni mọ
 54. ma sí mọ oyi nein feni mọ
 55. ma sí mọ oyi sọónrọn feni mọ (also, ma sí mọ die mọ)

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56. ma sí mọ oyi sondie feni mọ
 57. ma sí mọ oyi sọńmọma feni mọ
 58. ma sí mọ oyi niina feni mọ
 59. ma sí mọ oyi isé feni mọ
 60. tará sí (three twenties)
 61. tará sí mọ kẹnị mọ
 62. tará sí mọ mamụ mọ
 63. tará sí mọ taárụ mọ
 64. tará sí mọ nein mọ
 65. tará sí mọ sọńrọn mọ
 66. tará sí mọ sondie mọ
 67. tará sí mọ sọńmọma mọ
 68. tará sí mọ niina mọ
 69. tará sí mọ isé mọ
 70. tará sí mọ oyi mọ
 71. tará sí mọ oyi kẹnị feni mọ
 72. tará sí mọ oyi mamụ feni mọ
 73. tará sí mọ oyi taárụ feni mọ
 74. tará sí mọ oyi nein feni mọ
 75. tará sí mọ oyi sọńrọn feni mọ (also, tara si mọ die mọ)
 76. tará sí mọ oyi sondie feni mọ
 77. tará sí mọ oyi sọńmọma feni mọ
 78. tará sí mọ oyi niina feni mọ
 79. tará sí mọ oyi isé feni mọ
 80. nía sí
 81. nía sí mọ kẹnị mọ
 82. nía sí mọ mamụ mọ
 83. nía sí mọ taárụ mọ
 84. nía sí mọ nein mọ
 85. nía sí mọ sọńrọn mọ
 86. nía sí mọ sondie mọ
 87. nía sí mọ sọńmọma mọ
 88. nía sí mọ niina mọ
 89. nía sí mọ isé mọ
 90. nía sí mọ oyi mọ
 91. nía sí mọ oyi kẹnị feni mọ
 92. nía sí mọ oyi mamụ feni mọ
 93. nía sí mọ oyi taárụ feni mọ
 94. nía sí mọ oyi nein feni mọ
 95. nía sí mọ oyi sọńrọn feni mọ (also, nía si mọ die mọ)
 96. nía sí mọ oyi sondie feni mọ
 97. nía sí mọ oyi sọńmọma feni mọ
 98. nía sí mọ oyi niina feni mọ
 99. nía sí mọ oyi isé feni mọ
 100. sọńran sí

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101. sọ̀nran sí mọ kẹ̀nì mọ
 102. sọ̀nran sí mọ mamụ mọ
 103. sọ̀nran sí mọ taárụ mọ
 104. sọ̀nran sí mọ nein mọ
 105. sọ̀nran sí mọ sọ̀nron mọ
 106. sọ̀nran sí mọ sondie mọ
 107. sọ̀nran sí mọ sọ̀noma mọ
 108. sọ̀nran sí mọ niina mọ
 109. sọ̀nran sí mọ isé mọ
 110. sọ̀nran sí mọ oyi mọ
 111. sọ̀nran sí mọ oyi kẹ̀nì feni mọ
 112. sọ̀nran sí mọ oyi mamụ feni mọ
 113. sọ̀nran sí mọ oyi taárụ feni mọ
 114. sọ̀nran sí mọ oyi nein feni mọ
 115. sọ̀nran sí mọ oyi sọ̀nron feni mọ (also, sọ̀nrán sí mọ die mọ)
 116. sọ̀nran sí mọ oyi sondie feni mọ
 117. sọ̀nran sí mọ oyi sọ̀noma feni mọ
 118. sọ̀nran sí mọ oyi niina feni mọ
 119. sọ̀nran sí mọ oyi isé feni mọ
 120. sondia sí
 121. sondia sí mọ kẹ̀nì mọ
 130. sondia sí mọ oyi mọ
 140. sọ̀noma sí
 150. sọ̀noma sí mọ oyi mọ
 160. niina sí
 170. niina sí mọ oyi mọ
 180. iséna sí
 190. iséna sí mọ oyi mọ
 200. oyi sí
 - 220 oyi kẹ̀nì sí feni
 - 240 oyi ma sí feni
 - 250 oyi ma sí feni mọ óyí mọ
 - 260 oyi tará sí feni
 - 280 oyi nía sí feni
 - 300 oyi sọ̀nran sí feni (dia sí)
 - 320 oyi sondia sí feni
 - 340 oyi sọ̀noma sí feni
 - 360 oyi niina sí feni
 - 380 oyi iséna sí feni
 - 399 oyi iséna sí feni mọ oyi isé feni mọ (i.e. 380 and 19 = 399)
 - 400 **andẹ/ondẹ** (also, sía sí)
 - 500 andẹ mọ sọ̀nran sí mọ (also, sí sọ̀nran sí feni)
 - 600 andẹ mọ oyi sí mọ (sí oyi sí feni)/(andẹ mọ ekise mọ i.e. one and a half 400s)

700	andẹ mọ dia sí mọ	(sí oyi sọ̀nran sí feni)	(sí dia sí feni)
800	ma andẹ	(also, sí ma sí feni)	
900	ma andẹ mọ sọ̀nran sí mọ		
1000	ma andẹ mọ oyia sí mọ	(ma andẹ mọ ekise mọ i.e. two and a half 400s)	
1200	tará andẹ		
1600	níá andẹ		
2000	sọ̀nran andẹ		
10,000	sí sọ̀nran andẹ feni	(twenty-five 400s)	
100,000	andẹ oyi ma sí feni mọ oyi mọ	(two hundred and fifty 400s: 400 in 250 places)	
160,000	andẹ̀rimandẹ/ondẹ̀rimondẹ	(four hundred 400s: i.e. 400 into 400 places)	
1,000,000	sondia andẹ̀rimandẹ mọ andẹ sọ̀nran sí mọ	(six 160,000s and a hundred 400s)	
2,000,000	oyi ma andẹ̀rimandẹ feni mọ andẹ oyia sí mọ	(twelve 160,000s and two hundred 400s)	

b. *Counting money*

Traditionally, the Iẓon people used to count money of any currency, including cowries in those days, in bags (*akpa/akpaá*) of two hundred (200). Money is referred to in the various dialects of Iẓon as *sìlì* (predominantly), or *okubo/edọ̀lọ/okoba/igbegi/igboyi*, etc. One hundred (100) of whatever currency, for instance, would be regarded as half a bag of money. That is why it is wrong to standardize the number 100 as *akpaá* since *akpaá* is traditionally 200. (See section 1.8).

Money may also be counted as in the numbers in 1.1.1 above or 1.1.2 below, with the name of the currency coming after the number if it is less than 40 e.g. *Niina Naira* (N8); *sí oyi iséna dollar feni* (\$39), or with the name of the currency coming before the numbers 40 and above e.g. *Naira ma sí* (N40); *Naira sí sọ̀nran sí feni* or *Naira kẹ̀nì andẹ̀/ondẹ̀ mọ sọ̀nran sí mọ* (N500).

N100	sìlì akpa ekise	(a half bag of money)
N200	sìlì akpa	(a bag of money)
N300	sìlì akpa mọ ekise mọ	(one and a half bag of money)
N400	sìlì ma akpa	(two bags of money) (also, <i>Naira kẹ̀nì andẹ̀/ondẹ̀</i>)
N500	sìlì ma akpa mọ ekise mọ	(two and a half bags of money)
N600	sìlì tará akpa	(three bags of money)
N700	sìlì tará akpa mọ ekise mọ	(three and a half bags of money)
N800	sìlì níá akpa	(four bags of money) (also, <i>Naira ma andẹ̀/ondẹ̀</i>)
N900	sìlì níá akpa mọ ekise mọ	(four and a half bags of money)
N1000	sìlì sọ̀nran akpa	(five bags of money)
N1600	sìlì niina akpa	(also, <i>Naira níá andẹ̀/ondẹ̀</i>)
N2000	sìlì oyia akpa	(ten bags of money) (also, <i>Naira sọ̀nran andẹ̀/ondẹ̀</i>)
N4000	sìlì síá akpa	(twenty bags of money)
N5000	sìlì sí sọ̀nran akpa feni	(twenty-five bags of money)
N6000	sìlì sí oyia akpa feni	(thirty bags of money)
N8000	sìlì akpa ma sí	(forty bags of money)

N10000	sìlì akpa ma sí mọ oyi mọ	(fifty bags of money)
N20000	sìlì akpa sọ̀nran sí	(hundred bags of money)
N40000	sìlì akpa oyia sí	(two hundred bags of money)
N80000	sìlì akpa sía sí	(four hundred bags of money), etc.

1.2.2 Modern counting system in Iẓon

a. Cardinal numbers

0.	éyéfá /yéfaá	
1.	kẹ̀nì/kẹ̀nì	
2.	mamù/mamù/maamù	
3.	taárù/táárù/tárù	
4.	nein/nóin/ni	
5.	sọ̀nron/sọ̀nron/sọ̀nron/sọ̀nrùn	
6.	sondie/sóndié/seindie/síndió/sídíó	
7.	sọ̀noma/sọ̀noma	
8.	niina/nina/níngína/níngini/níngíne	
9.	isé/esé/ísín	
10.	oyi/óí	
11.	oyi kẹ̀nì feni	(ten and one)
12.	oyi mamù feni	(ten and two)
13.	oyi taárù feni	
14.	oyi nein feni	
15.	oyi sọ̀nron feni	
16.	oyi sondie feni	
17.	oyi sọ̀noma feni	
18.	oyi niina feni	
19.	oyi isé feni	
20.	ma oyi	(i.e. 'two tens')
21.	ma oyi kẹ̀nì feni	(two tens and one)
29.	ma oyi isé feni	(two tens and nine)
30.	tará oyi	(i.e. three tens)
31.	tará oyi kẹ̀nì feni	
40.	nía oyi	(i.e. four tens)
45.	nía oyi sọ̀nron feni	
50.	sọ̀nran oyi	(i.e. five tens)
60.	sondia oyi	(i.e. 'six tens')
70.	sọ̀noma oyi	(i.e. 'seven tens')
80.	niina oyi	(i.e. 'eight tens')
90.	iséná oyi	(i.e. 'nine tens')
100.	ọ̀dọ̀zọ	
104.	ọ̀dọ̀zọ nein feni	
110.	ọ̀dọ̀zọ oyi feni	
120.	ọ̀dọ̀zọ ma oyi feni	
199.	ọ̀dọ̀zọ iséná oyi isé feni	
200.	ma ọ̀dọ̀zọ	

900.	iséná ọdọzọ
1000.	ọgíẓí
1003.	ọgíẓí taáru feni
1600.	ọgíẓí sondia ọdọzọ feni
2000.	ma ọgíẓí
10,000.	oyia ọgíẓí
100,000.	ọdọzọ ọgíẓí
600,000.	sondia ọdọzọ ọgíẓí
1,000,000.	ipámù
700,000,000	sónoma ọdọzọ ipámù
1,000,000,000	ọgíẓí ipámù
800,000,000,000	niina ọdọzọ ọgíẓí ipámù
1,000,000,000,000	ẹndẹrí

many *izan*; few *dọlọ*; little *kpoyogha*

b. *Ordinal Numbers*

- 1st bụlọ
- 2nd mamù karamọ
- 3rd taáru karamọ
- 4th nein karamọ
- 5th sọnron karamọ

1.3 On the origin of 400 in the traditional numeral system of Iẓon

Since counting in Iẓon was done in bundles or sets of twenties in the olden days as can be witnessed from 1.1 above, it follows logically that the highest number that could be counted at a time as at that time was *sía sít* i.e. twenty twenties which amounted to 400 (i.e. $20 \times 20 = 400$). Another name for *sía sít* ‘four hundred’ (400) is *kẹnị andẹ/ọndẹ*. This, perhaps, is the origin of 400 as the highest number in the traditional numeral system of Iẓon. After each *andẹ/ọndẹ*, the counting begins again at

- 1. kẹnị/kẹnị,
- 2. mamù/mamù/maamù,
- 3. taáru/táru/táárú,
- 4. nein/nóin/ni,
- 5. sọnron/sónron/sọnron/sónrùn,
- 6. sondié/sóndié/seindié/síndió/sídíó,
- 7. sọnoma/sónoma,
- 8. niina/nína/níngína/níngíní/níngínẹ,
- 9. isé/esé/ísín,
- 10. oyi/ói

until it reaches another *sía sí* or *kẹnị andẹ/ọndẹ* ‘four hundred’ (400).

1.4 Manipulating high numbers in the counting system of Iẓon

The traditional counting system in Iẓon, as also observed in Echie by Ndimele (2003:119), is a complex system which involves complex mathematical manipulations of smaller numbers through the processes of addition and multiplication to derive large numbers such as *keni ande/onde* (400) and above. This counting of numbers in *sia sii* or *ande/onde* also continues until the number *anderimande/ onderimonde* i.e. 160,000 is reached. Thereafter, it is up to the person counting to determine whether their memory could cope with the addition of further *ande/onde* or *anderimande/ onderimonde*. It must be noted however, that in this tedious way, millions and even billions as we understand them in English could be counted.

1.5 The relationship between the numerals and other aspects of the grammar

Note that when used as a number qualifier i.e. as an adjective before another number or currency:

- i. *mamu/mamú/maamú* changes to the short form *ma/maa*. Thus we say *ma sí* for 40 i.e. two twenties, instead of ‘*mamu sí*’. This is an elision process where word-final [mú] becomes deleted.
- ii. *taáru/tárú/táárú* changes to *tará/táára*. Thus we say *tará sí* for 60 i.e. three twenties, instead of ‘*taáru sí*’. That is, word-final [ú] rewrites as [a].
- iii. *nein/nóin/ni* changes to *niá*. Thus we say *niá sí* for 80 i.e. four twenties, instead of ‘*nein sí*’. That is, [ei, ói, i] rewrite as [ia]. There is an addition of [a] to the final vowel in the numeral ‘four’.
- iv. *sóónron/sónron/sóónrón/sónrún* changes to *sóónran*. Thus we say *sóónran sí* for 100 i.e. five twenties, instead of *sóónron sí*. That is, word-medial [ɔ, ɔ, ɔ] rewrite as [a].
- v. *sondie/sóndié/seindie/síndió/sídíó* changes to *sondia/sóndiá*. Thus we say *sondia sí* for 120 i.e. six twenties, instead of *sondie sí*. That is, word-final [e, é, ó] rewrite as [a].
- vi. *níngíní/níngíné* changes to *niina*. Thus we say *niina sí* for 160 i.e. eight twenties, instead of *níngíní/níngíné sí*. That is, [í, ẹ] rewrite as [a].
- vii. *isé/esé/isín* changes to *isená/eséna*. Thus we say *isená sí* for 180 i.e. nine twenties, instead of *isé/isín sí*. That is, there is an addition of [na] to *isé/esé/isín* to form *isená/eséna*.
- viii. *oyi /ói* changes to *oyía/óyía*. Thus we say *óyía sí* for 200 i.e. ten twenties, instead of *óyí/ói sí*. That is, there is an addition of [a] to the final vowel in the numeral.

The changes observed above may be clitic forms used especially with numbers in Iẓon when they perform the function of adjectives, and would be fully investigated later on, in another paper to be dedicated to phonological processes and cliticisation in Iẓon.

1.6 The endangerment of the numeral system of Iẓon

The endangerment of the numeral system of Iẓon is due largely to the incursion of the English language into all aspects of the lives of the Iẓon people, including our traditional ways of life and culture. This is due to social changes caused by industrialization and urbanization, as well as the desire for social and vocational mobility in order to obtain an improved standard of living. The patterns in the language use of Iẓon communities has also changed and we have created new patterns of social interaction as Iẓon speakers become bilingual and prefer the use of English in counting. Except in the most remote villages and in rural markets in Iẓonland where the people still endeavour to count in Iẓon, English (or at least the code-mixing/code switching form of it) is used for counting. Another factor is the disloyalty of the Iẓon people towards their language, by not sticking to their mother-tongue and preferring to use English which is the second language of the educated elites.

1.7 Apparent mixture in the numeral base systems in Iẓon

The traditional counting system in Iẓon is 10-based up to 19, 20-based up to 400 and a mixture of 10-based, 20-based and 400-based thereafter. (see 1.1.1 above). That is, 1, 2, 3, ... up to 10; 11 is 10 plus 1; 12 is 10 plus 2; 19 is 10 plus 9; etc. These numbers are in base 10. It is 20-based from 20 up to 400. For example, 21 is 20 plus 1; 39 is 20 plus 19; 40 is two 20s; 400 is twenty 20s. It is 400-based from 400. Thus, 403 is 400 and 3; while 800 is two 400s. The highest simple place value in the traditional numeral system of Iẓon is *kẹnị andẹ/onde* (400). *andẹrịmandẹ/ondẹrịmondẹ* (one hundred and sixty thousand: 160,000 i.e. 400 x 400) is a derived place-value.

1.8 Standardisation and the loss of traditional counting system in Iẓon

The standardization of the counting system of Iẓon in 1990 in the Kolokuma dialect by Williamson, Timitimi, Egberipou, Vianana, and Odogu (see 1.9 below) in Nigerian Educational Research and Development Council and National Language Centre's *A Vocabulary of Primary Science and Mathematics in Nine Nigerian Languages* has led to the loss of the traditional counting system in the Kolokuma dialect of Iẓon at least. However, it is pertinent to note that the traditional counting system of Iẓon is still popular among the illiterate and literate speakers of all the other dialects of Iẓon, as well as a good number of speakers of Kolokuma. The standardized modern counting system proposed for Iẓon by Williamson et al in Kolokuma is as follows:

0. yéfaá
1. kẹnị
2. mamụ
3. tárụ
4. nóín
5. sọnrón
6. sọndié
7. sọnọma
8. níngíni
9. isé
10. óí

-
11. óí kẹ̀nì fị́nì (ten and one)
 12. óí mamụ́ fị́nì (ten and two)
 13. óí táru fị́nì
 14. óí nóín fị́nì
 15. óí sọnrọ́n fị́nì
 16. óí sọndíé fị́nì
 17. óí sọnọ́ma fị́nì
 18. óí níngínì fị́nì
 19. óí isé fị́nì
 20. ma óí (i.e. ‘two tens’)
 21. ma óí kẹ̀nì fị́nì (twenty and one)
 29. ma óí isé fị́nì (twenty and nine)
 30. tárá óí (i.e. three tens)
 31. tárá óí kẹ̀nì fị́nì
 40. nía óí (i.e. four tens)
 45. nía óí sọnrọ́n fị́nì
 50. sọnrán óí (i.e. five tens)
 60. sọndiá óí (i.e. ‘six tens’)
 70. sọnọ́má óí (i.e. ‘seven tens’)
 80. níngíná óí (i.e. ‘eight tens’)
 90. iséná óí (i.e. ‘nine tens’)
 100. akpaá/ọ̀dọ̀zọ́
 104. ọ̀dọ̀zọ́ nóín fị́nì
 110. ọ̀dọ̀zọ́ óí fị́nì
 120. ọ̀dọ̀zọ́ ma óí fị́nì
 199. ọ̀dọ̀zọ́ iséná óí isé fị́nì
 200. ma ọ̀dọ̀zọ́
 900. iséná ọ̀dọ̀zọ́
 1000. ọ̀gị́zị́
 1003. ọ̀gị́zị́ táru fị́nì
 1600. ọ̀gị́zị́ sọndiá ọ̀dọ̀zọ́ fị́nì
 2000. ma ọ̀gị́zị́
 - 10,000. óíya ọ̀gị́zị́
 - 100,000. ọ̀dọ̀zọ́ ọ̀gị́zị́
 - 600,000. sọndiá ọ̀dọ̀zọ́ ọ̀gị́zị́
 - 1,000,000. ipámụ́
 - 700,000,000 sọnọ́má ọ̀dọ̀zọ́ ipamụ́
 - 1,000,000,000 ọ̀gị́zị́ ipámụ́
 - 800,000,000,000 níngíná ọ̀dọ̀zọ́ ọ̀gị́zị́ ipamụ́
 - 1,000,000,000,000 ẹ̀ndẹ́rị́

It is pertinent to mention here however, that Williamson et al (1990) use of *akpaá/ọ̀dọ̀zọ́* for the numeral one hundred (100) is erroneous because traditionally, the Iẓon people use *akpaá* for a bag of money of whatever currency (Naira, U.S.Dollar,

British Pound, etc.) which is for all intents and purposes N200, \$200 etc. The *odózo* has been accepted and used by some Iẓon speakers, but only a few, if any, would even think of using *akpaá* as 100 especially in reference to money.

1.9 Language engineering, numeracy and the implications for teaching science and technology in Iẓon.

The *Oxford Advanced Learner's Dictionary* gives the meaning of numeracy as “a good basic knowledge of mathematics; the ability to understand and work with numbers.” In 1990, the Nigerian Educational Research and Development Council in collaboration with the National Language Centre published *A Vocabulary of Primary Science and Mathematics in Nine Nigerian Languages* including Iẓon with a view to providing technical terminologies in science and mathematics in primary schools in these Nigerian languages. The Iẓon team consisted of Professor Kay Williamson (the Editor) of the University of Port Harcourt, Mr A.O. Timitimi, Mr O.A. Egberipou, Mr N.T.S. Vianana, and Mr C.T. Odogu. Dr P.N. Okonta and Dr S. Odi-Owei served as Technical Advisers. The dialect used is Kolokuma. This glossary is a product of language engineering. It contains mathematical terms and numerals, numbers, operations, measurements, practical and descriptive geometry, everyday statistics, set theory, scientific terms in the physical sciences and terms used in primary science. This has prepared the foundation/background for numeracy and the teaching of science and technology in Iẓon at the Universal Basic Education level.

2. Conclusion

We note that when used as a number qualifier i.e. as an adjective before another number or currency:

- i. The word-final morpheme of *mamụ* is elided i.e. [mụ] becomes deleted through an elision process.
- ii. Word-final [ụ] in *taáru* rewrites as [a] in *tará*.
- iii. There is an addition of [a] to the final vowel [ei, ói, i] in the numeral ‘four’.
- iv. Word-medial [ọ, ọ, ụ] in *sọonrọn/sónrọn/sọonrọn/sónrún* rewrite as [a] in *sọonran*.
- v. Word-final [e, é, ó] in *sondie/sóndié/seindie/síndió/sídió* rewrite as [a] in *sondia*.
- vi. Word-final [í, ẹ] in *níngíní/níngínẹ* rewrite as [a] in *niina*.
- vii. There is an addition of [na] to *isé/esé/ísín* to form *iséná/eséna*.
- viii. There is an addition of [a] to the final vowel [i, í] in the numeral *oyi/ói*.

Numbers play an important role in the traditional life of the Iẓon people, both for ordinary counting and for monetary matters. The Iẓon numeral system or number system is self-sufficient. It is used as the basis for counting money and other things, expressing the quantities of things, determining position, and performing calculations. Therefore, the Iẓon need to be encouraged by us as linguists to use their language for the above-mentioned purposes at all times in order not to endanger their numerical system, and indeed their language.

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The Kilba Traditional Numeral System

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The paper examines the Kilba numeral system – the language of the Bata Marghi subgroup of the Chadic family of the Afro-Asiatic phylum – which is predominantly spoken in Hong and Gombi Local Government Areas of Adamawa State, Nigeria. The paper discusses the different systems of numeration in the language, which include the following: cardinal, ordinals, numerals adverbs, distributive numerals, fraction and other expressions of quantity in the language.

1. The cardinal numerals

The cardinal numerals are just the ordinary counting system in Kilba, as shown below:

dzàng	1 (one)
mətlù	2 (two)
màkər/màkərù	3 (three)
fòdù	4 (four)
tùfù	5 (five)
kwà	6 (six)
məðəfà	7 (seven)
cìsù	8 (eight)
dlà	9 (nine)
kùmà/kùm	10 (ten)
kwábù-dzàng	11 (eleven)
kwábù-mətlù	12 (twelve)
kwábù-màkər/màkərù	13 (thirteen)
kwábù-fòdù	14 (fourteen)
kwábù-tùfù	15 (fifteen)
kwábù-kwà	16 (sixteen)
kwábù-məðəfà	17 (seventeen)
kwábù-cìsù	18 (eighteen)
kwábù-dlà	19 (nineteen)
mətlù-kùmnyì	20 (twenty)
mətlù-kùmnyì –pàrnyà-dzàng	21 (twenty one)
mətlù-kùmnyì-pàrnyà-mətlù	22 (twenty two)
mətlù-kùmnyì-pàrnyà-màkər	23 (twenty three)
mətlù-kùmnyì-pàrnyà-fòdù	24 (twenty four)
mətlù-kùmnyì-pàrnyà-tùfù	25 (twenty five)
màkər/màkərù-kùmnyì	30 (thirty)
fòdù-kùmnyì	40 (forty)
tùfù-kùmnyì	50 (fifty)
kwà-kùmnyì	60 (sixty)
məðəfà-kùmnyì	70 (seventy)
cìsù-kùmnyì	80 (eighty)

dlà-kùmnyi	90 (ninety)
àrù/àrù-dzàng	100 (one hundred)
àrù-nəu-dzàng	101 (one hundred and one)
àrù-nəu-mətlù	102 (one hundred and two)
àrù-nəu-kùmà	110 (one hundred and ten)
dùbù/dùbù-dzàng	1,000 (one thousand)
dùbù-dùbù(miliyòn-dzàng)	1,000,000 (one million)

Based on the above examples, it is clear that to form tens in Kilba the cardinal units are suffixed to the morpheme *-kwábù* and *pàrnyà* (Hong form)/ *tàrnyà* (Gaya form). While, in twenties up to ninety the cardinal units are prefixed to the morpheme *-kumnyi* and hundreds use the morphemes *àrù* and *nə* followed by the cardinal unit while thousands and millions used the morpheme *-dùbù* following the same Pattern explained in the other processes. All the morphemes have a low tone with the exception of *kwábù*, which has a high low tone pattern.

2. The ordinal numerals

The ordinal numerals in Kilba are derived from cardinal numerals through the processes of suffixation. The suffix morph/morpheme *-kùr* or *-kùnnyi* is suffixed to the cardinal in order to have the ordinal, with the exception of first (1st) which uses different stem from the cardinal numeral.

Examples are provided below:

tàngərmà	1 st (first)
mətlùkùr/məthlùkùnnyi	2 nd (second)
màkər /màkərùkùr/màkər̀kùnnyi	3 rd (third)
fòdùkùr/fòdùkùnnyi	4 th (fourth)
tùfùkùr/tùfùkùnnyi	5 th (fifth)
kwàkùr/kwàkùnnyi	6 th (sixth)
məðəfàkùr/məðəfàkùnnyi	7 th (seventh)
cìsùkùr/cìsùkùnnyi	8 th (eighth)
dlàkùr/dlàkùnnyi	9 th (ninth)
kùmà/kùm̀kùr/kùm̀kùnnyi	10 th (tenth)
kwábùdzàngkùr/kwábùdzàngkùnnyi	11 th (eleventh)
kwábùmətlùkùr/kwábùmətlùkùnnyi	12 th (twelfth)
mətlùkùmnyikùr	20 th (twentieth)
màkər/màkər̀kùmnyikur	30 th (thirtieth)
fòdùkùmnyikùr	40 th (fortieth)
tùfùkùmnyikùr	50 th (fiftieth)
kwàkùmnyikùr	60 th (sixtieth)
məðəfàkùmnyikùr	70 th (seventieth)
cìsùkùmnyikùr	80 th (eightieth)
dlàkùmnyikùr	90 th (ninetieth)
àrùkùmnyikùr	100 th (one-hundredth)
dùbùkùmnyikùr	1,000 th (one- thousandth)
dùbùdùbùkùmnyikùr	1,000,000 th (one-millionth)

As seen from the above examples, the suffix *-kùr/-kùnyì* is added to the last part of the number from 2nd (second) up to 12th (twelve). But in order to form 20th to million, the rules change because *kùnyìkùr* comes after the cardinal numeral as a compound morpheme not as an independent morpheme in free variation as observed in the formation of 2nd (second) to 12th (twelfth). In the same vein, there seems to be no tonal differences between the cardinal and the ordinal numerals in the Kilba language.

3. Numeral adverbs

In Kilba, numeral adverbs are formed through the process of prefixation. This means that a morpheme *sò-* is added or prefixed to the cardinal numerals, as shown below:

<i>sò dzàng</i>	once
<i>sò mètù</i>	twice
<i>sò màkər /màkərùkù</i>	thrice/three times
<i>sò fòdù</i>	four times.
<i>sò tùfù</i>	five times
<i>sò kwà</i>	six times.
<i>sò zhàkà mədəfà</i>	seven times
<i>sò zhàkà cìsù</i>	eight times.
<i>sò dlà</i>	nine times
<i>sò kùmà/kùm</i>	ten times

It is important to point out that there is another morpheme that is used to form the numeral adverbs in the language, although it is not used frequently by the younger generation. It is used mostly by the older generation around Hong and Gombi local government areas of the State. The form is the morph *zhàkà-*. It follows the same process as we observed above in numeral adverb formation with the morph *-sò*, as exemplified below:

<i>zhàkà dzàng</i>	once
<i>zhàkà mètù</i>	twice
<i>zhàkà màkər/màkərùkù</i>	thrice/three times
<i>zhàkà fòdù</i>	four times
<i>zhàkà tùfù</i>	five times
<i>zhàkà kwà</i>	six times.
<i>zhàkà mədəfà</i>	seven times
<i>zhàkà cìsù</i>	eight times.
<i>zhàkà dlà</i>	nine times
<i>zhàkà kùmà/kùm</i>	ten times

The two morphs/morphemes i.e. *sò-* and *zhàkà-* can be said to be in free variation because they can be used interchangeably without affecting the meaning. The only issue observed is that while, the first *-sò* is commonly used the latter *-zhàkà* is mostly used, by the older people in the community.

4. Distributive numerals

The Kilba distributive numerals are formed through reduplication processes. The cardinal numerals or numbers undergo the process of complete/total reduplication and partial reduplication, depending on the one chosen by the speaker:

Complete/total reduplication

zhàng-zhàng/pàtlù-pàtlù	one each
mətlù-mətlù	two each
màkər-màkər/ màkərù màkərù	three each
fòdù-fòdù	four each
tùfù-tùfù	five each
kwà-kwà	six each
məðəfà-məðəfà	seven each
cìsù-cìsù	eight each
dlà-dlà	nine each
kùmà-kùmà/kùm-kùm	ten each
kwábù zhàng-kwábù dzàng	eleven each
kwábù mətlù-kwábù mətlù	twelve each
mètlùkùmnyì-mètlùkùmnyì	twenty each
mètlùkùmnyì pàrnyà zhàng-mètlùkùmnyì-pàrnyà zhàng	twenty one each
mètlùkùmnyì pàrnyà mətlù-mètlùkùmnyì-pàrnyà mətlù	twenty two each
mètlùkùmnyì pàrnyà màkər-mètlùkùmnyì-pàrnyà màkər	twenty three each
mètlùkùmnyì pàrnyà fòdù-mètlùkùmnyì-pàrnyà fòdù	twenty four each
mètlùkùmnyì pàrnyà tùfù-mètlùkùmnyì-pàrnyà tùfù	twenty five each
àrù-àrù/ àrù zhàng-àrù zhàng	one hundred each
dùbù-dùbù/ dùbù dzàng-dùbù-dzàng	one thousand each

Patial reduplication

zhàzhàng/pàpàtlù	one each
məmətlù	two each
màmàkər/màmàkərù	three each
fòfòdù	four each
tùtùfù	five each
kwà-kwà	six each
məməðəfà	even each
cìcìsù	eight each
dlà-dlà	nine each
kùmà-kùmà/kùm- kùm	ten each
kwábù zhàzàng	eleven each
kwábù məmətlù	twelve each
mètlùkùmnyì-kùmnyì	twenty each
mètlùkùmnyì pàrnyà zhàng-zhàng	twenty one each
mètlùkùmnyì pàrnyà mətlù-mètlù	twenty two each
mètlùkùmnyì pàrnyà màkər-màkər	twenty three each
mètlùkùmnyì pàrnyà fòdù-fòdù	twenty four each

mètlùkùmnyì pàrnyà tùfù-tùfù	twenty five each
àrù-àrù/ àrù zhàng-zhàng	one hundred each
dùbù-dùbù/ dùbù zhàng-zhàng	one thousand each

As seen from the preceding examples, Kilba distributive numerals can be formed through the process of both complete and partial reduplication. However, not all the cardinal numerals follow the rules of partial reduplication. There are a few exceptional cases as seen in *kwà-kwà* “six each” *dlà-dlà* “nine each” and *kùmà-kùmà/kùm-kùm* “ten each” respectively. All other cardinal numerals, apart from those pointed out earlier; follow the partial reduplication process rules in the formation of distributive numerals. Similarly, it has also been observed that the tones before and after being reduplicated completely /totally or partially remain constant.

6. Kilba fraction

Fraction in the language is expressed by the words *mànyì/màr* and *rètà* (borrowed from Fulfulde) meaning “half”, while the other fractions are expressed by the ordinal numeral e.g. “third” “*màkərùkùr/kùmnyì*” fourth “*fòḍùkùr/kùmnyì*” (cf. Muazu, 2009:97) for more detailed examples. In Kilba, the word is added to the noun in question and it has a low-low tonal patterns. Examples are shown in 6 below:

mànyì/màr/rètà	half
gàdùbùl mànyì/màr/rètà	half the wrapper
màl mànyì/màr/rètà	half the oil
ùhì mànyì/màr/rètà	half the guinea corn
kùdàkù mànyì/màr/rètà	half the sweet potato
kùm mànyì/màr/rètà	half the meat

7. Other expressions of quantity in Kilba

There are other words in Kilba which are classified as expressions indicating some kind of quantity. It is important to note that they are not a grammatical category, in the language, but they play a very prominent role in describing certain things/situations. Among these are: *bàḍəgàl* which means “a great deal” and the following words: *cá/cá,à /cá/cá/cá,cá,à* “*dəhù*” and “*pàpàtù*” or “*pàtù*” all the three words stand for the English word “all” in the language.

bà ḍəgàl	“a great deal”
bà ḍəgàl nì ndà	most of the people/the majority of the people
nì bà ḍəgàl ndà	most of the people/the majority of the people
bà ḍəgàl nì ndà təràti	most of the people/the majority of the people left.
nì bà ḍəgàl ndà təràti	most of the people/the majority of the people left.
bà ḍəgàl màhì,ì ndà shilti	most of the women came/majority of the women came
màhì,ì bà ḍəgàl ndà shilti	most of the women came/majority of the women came
cá/cá,à /cá/cá/cá,cá,à	all
nì cà	all people
màhì,ì cà,à	all women

nji càcà	all people
màhì,ì càcà,à	all women
cà nji	all people
cà,à màhì,ì	all women
càcà nji	all people
càcà,à màhì,ì	all women
càcà àndà	all of them
dəhù	all
nji dəhù	all people
màhì,ì dəhù	all women
dəhù nji càcà	all people
dəhù màhì,ì	all women
dəhù ndà	all of them
dəhù mà	all of us
dəhù hyì	all of you(pl)
pàpàtù/pàtù	all
nji pàpàtù / pàtù	all people
màhì,ì pàpàtù/ pàtù	all women
nji pàpàtù / pàtù	all people
pàpàtù/ pàtù màhì,ì	all women
pàpàtù / pàtù ndà	all of them
pàpàtù / pàtù mà	all of us
pàpàtù / pàtù dəhù hyì	all of you(pl)

As revealed from the examples, the Kilba word “bà dægàl” (a great deal of) as well as the three various words for all in Kilba can be used alone after or before a noun. In addition for the three words for “**all**” in the language it can be used before a possessive short pronoun to express the feature of “all”.

Finally, it is important to point out that apart from the conventional numeral system in the language; there are other numeral systems used to express numbers in the language that is not taken into account by this study. Because of the fact that their origin seems to be of loan words i.e. the numeration system are borrowed from other languages.

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Numeral Classifiers in Gokana and Kana

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This paper describes the numeral classifier systems in Gokana and Kana. It draws attention to aspects of the classifier system where there are variations between the two languages. The paper shows that there are more classifiers in Gokana than Kana. It argues that there is a difference between the morphological structure of the classifier systems in Gokana and Kana. Whereas in Gokana, numeral classifiers form a morphological unit with the numeral, in Kana, numeral classifiers form a morphological unit with the enumerated noun. The paper argues that the classifier systems of both languages are also based on the symmetry between the grammatical functions of the classifier and the classified and not only on their semantic interpretations. The paper shows that number distinction in Gokana is determined by the classifier system. This explains why nouns do not agree in number with verbs, and there is no grammatically marked singular/plural alternation.

1. Introduction

Gokana is spoken in Gokana Local Government Area of Rivers State, Nigeria by approximately 200,000 people. It is closely related to Kana, which is spoken in Kana Local Government Area of Rivers State, Nigeria, by approximately 300,000 people. Both languages belong to the Kegboid group. Other languages in the group are Baan, Eleme and Tee. Williamson and Blench (2000:33) classify Kegboid in Delta-Cross of Cross River within Bantoid-Cross of the East Benue-Congo branch of Benue-Congo.

This paper argues that Gokana and Kana have lost their noun class systems which is a feature of Proto-Cross River but a new system of numeral classifiers have developed in these languages. The paper describes the numeral classifier system in Gokana and makes an objective comparison with Kana in areas of the classifier system where certain variations occur.

2. The Phenomenon of Classifiers

According to Allan (1977) there are four distinct types of classifier systems. These are numeral classifiers, concordial classifiers, predicate classifiers and intra-locative classifiers. Within these range of classifiers, two of them – numeral and concordial classifiers (noun classes) have been given prominent attention in the linguistic literature.

Dixon (1986:105) states that a concordial classifier system “constitutes an obligatory grammatical system, where each noun chooses one from a small number of possibilities” on the other hand, a numeral classifier system is a set of independent morphemes which occur between a number and an enumerated noun in counting constructions. Classifiers are also referred to as noun counters.

It is very common to find concordial classifier systems or noun class systems in African as well as Australian languages, and numeral classifiers as a feature of American Indian or Asian languages. According to Williamson (1989:31),

The best known feature of Niger-Congo languages is undoubtedly their system of noun classification, which is a well preserved system, reduced or purely vestigial form, can be traced in every branch of the family, and hence must be reconstructed for Pro-Niger-Congo.

Proto-Cross River inherited the noun class system from Proto-Benue-Congo, which in turn retained such a system from Proto-Niger-Congo. Ikoro (1994) asserts:

Faraclas (1986:39, 1989:389) points out, in present day Cross River languages, there are various things going on with respect to the inherited system of noun classification. In some Upper-Cross languages, such as Mbembe (Barnwell 1969) the system is still functioning though there are few cases of nouns without any singular-plural alternations. In other subgroups, such as Lower-Cross, the noun class system is clearly moving out. Faraclas (1984) and Connel (1991) also show that some other Lower-Cross languages such as Obolo, Annang and Ibibio have lost the noun class system ... In the Kegboid group, the Proto-Cross River noun class system has completely broken down.

But there is a new system of classifiers evolving in the Kegboid group – the numeral classifier system and Ikoro (1994) describes the system in Kana. In the remainder of this paper, we shall not only describe the numeral classifier system in Gokana but we shall also draw attention to interesting parametric variations between Gokana and Kana (very closely related languages) in the grammar of numeral classifiers.

3. Numeral Classifiers in Gokana and Kana

The major organizing principle in the numeral classifier systems of both Gokana and Kana is shape. In both systems the classifier and the classified must bear a similar shape. Whereas Kana classifiers mostly refer to long and flat shapes (Ikoro 1994); Gokana classifiers assume more shapes than their Kana counterparts. The semantic range of shapes that co-occur with Gokana classifiers mostly include round, rectangular, spherical, triangular, long and flat shapes.

Apart from shape, both languages also show certain levels of similarities and differences in a number of other features with respect to their numeral classifier systems. In what follows, we shall discuss these features:

3.1 Morphological Structure of the Classifier System

In Gokana, the numeral classifier forms a morphological unit with the numeral; whereas in Kana, the numeral classifier forms a morphological unit with the enumerated noun. We note here that the situation in Kana is a parametric variation as most studies on numeral classifier systems attest to the claim that the numeral classifier may form a morphological unit with the numeral and not with the enumerated noun (cf. Allan 1977; Dixon 1986). To illustrate this contrast, we present the following data:

1. Morphological structure of numeral classifiers in Kana, Ikoro (1994:22):

- a) zìi pià kà péé 'One bad goat'
 one bad CL goat
- b) zìi gbene kà péé 'One big goat'
 one big CL goat
- c) zìi lé kà péé 'One good goat'
 one good CL goat
- d) zìi námá ásúú kpàkpàa 'One old maize grain'
 one old CL maize
- e) zìi kááná té fa 'One nice (very big) vehicle'
 one excellent CL boat

Observe that in (1a-e) the numeral classifiers in Kana immediately precede the enumerated noun, and in this position form a morphological unit with the noun. In effect, there can be no intervening word between the classifier and the noun. A violation of this surface order accounts for the ungrammaticality of (2a-e):

- 2a) *zìi kà pià péé
 one CL bad goat
- b) *zìi kà gbn péé
 one CL big goat
- c) *zìi kà lé péé
 one CL good goat
- d) *zìi ásúú námá kpàkpàa
 one CL old maize
- e) *zìi té kááná fa
 one CL excellent boat

By contrast, in Gokana, a numeral classifier forms a morphological unit with the numeral and not with the noun. Unlike the situation in Kana, there can be an intervening word between the classifier and the classified noun, as shown in (3a-e):

- 3a) enè kà póló ból 'One bad goat'
 one CL bad goat
- b) enè kà pòb ból 'One big goat'
 one CL big goat

-
- c) enè kà lé ból 'One good goat'
 one CL good goat
- d) enè súú nóma kpákyàlà 'One old maize grain'
 one CL old maize
- e) enè té lé faà 'One nice boat'
 one CL goat boat

The situation in Gokana is different from that in Kana; thus there can be no intervening word between a numeral and the classifier, except the intervening word is a modifier of the classifier, in which case the intervening word is considered an associative element of the classifier, as shown in (4a-b):

- 4a) enè póló kà ból 'One bad goat'
 one bad CL goat
- b) enè lé té faà 'One nice boat'
 one good CL boat

Numeral classifiers also co-occur with more nouns in Gokana than in Kana. Thus, more numeral classifiers have been attested in Gokana than Kana. Ikoro (1994) identified sixteen numeral classifiers in Kana, but so far we have identified forty-two numeral classifiers in Gokana. Unlike noun class systems which typically comprise a closed set of two to twenty classes, into which all nouns in the language are divided. Classifier systems typically involve 20 or more classifiers (Senft 2008:30). The etymological source of some of the Gokana classifiers can still be traced synchronically. The classifiers are listed in Figure 1.1:

Fig. 1.1: Numeral Classifiers and Probable Etymologies

GOKANA			KANA COGNATES		
Classifier	Probable Etymology		Classifier	Probable Etymology	
ká	kà	mother	kà	kà	mother
té	té	tree	té	té	tree
kum	kum	bunch	kum	kum	bunch
kérè	kérè	half	kérè	kée	half
nvín	nvín	child	nwíí	nwíí	child
kó	kó	pack	kó	kó	pack
nen	nen	person	nee	nee	person
pél	pél	piece	apéeé	apéeé	piece of
súú	súú	grain	asúú	ásúú	grain
kpò	kpò	heap	kpò	kpò	heap
bàà	bàà	part of	àbà	àbà	part of
dēe	dēe	eye	dēe	dēe	eye

kpá	kpá	skin	ákpá	ákpá	skin
pa	pa		àpa	àpa	
gǔ	gǔ	bunch			
zári	zári				
kò	kò				
gě	gě	fire			
bíra	bíra	liquid			
pee	pee				
lógó	lógó				
ságǎ	ságǎ				
kpó	kpó	box			
tî	tî	container			
gboo	gboo	wall			
tǎa	tǎa	line			
kóróká	kóróká				
kpégé	kpégé				
tóm	tóm	work			
bú	bú	bowl			
bób	bób	bundle			
bǎ	ǎ	pot			
kpóó	kpóó	bone			
dém	dém	tongue			
nvé	nvé	sucker			
kpúró	kpúró	tuber			
koò	koò	horn			
togó	togó	head			
léb	léb				
ból	ból	fruit			
beg	beg	length			
tòò	tòò				

Notice that the first fourteen classifiers identified in Gokana also have cognates in Kana. Whereas in Gokana, it is only nouns indicating units of time that lack classifiers; in Kana, nouns indicating units of time, units of currency and units of distance do not take classifiers. The difference in the range of nouns that require classifiers in Gokana and Kana is exemplified in Figure 1.2:

Fig. 1.2: Differences in classifier usage in Gokana and Kana

S/No.	Gokana	Kana
	Units of currency	
5(a)	bàà kà kóbò two CL kobo 'two kobo'	bàà kobo two kobo 'two kobo'

(b)	vòò kà nàílà five CL naira 'five naira'	òò nàárá five naira 'five naira'
Unit of distance		
(c)	vòò kà máèl five CL mile 'five miles'	òò máèl five mile 'five miles'

Observe that the Gokana noun phrases in (5a-c) contain the classifier **kà** while the Kana noun phrases in (5a-c) lack classifiers. The classifier **kà** in the Gokana construction is obligatory for the grammaticality of these constructions. If the classifier is deleted, the Gokana constructions will become ungrammatical as in (6a-c):

6a) *bàà kobo
two kobo

b) *vòò nàílà
five naira

c) *vòò máèl
five mile

3.2 Syntactic Structure of the Classifier System

In Gokana, classifiers are not mobile categories. They occupy only a specific syntactic position. They can only be found in a noun phrase in a position immediately after a numeral. No syntactic or semantic constraint can cause an alternation in this word order. Gokana classifiers have a fixed word order: Num + CL + N.

In syntactic distribution, many nouns can occur with more than one classifier, as in (7)-(9):

- 7a) bàà kà faà 'two boats'
two CL boat
- b) bàà té faà 'two boats'
two CL boat
- c) bàà táá faà 'two lines of boat'
two CL boat
- d) bàà tòò faà 'two 'groups' of boats'
two CL boat
- 8a) bàà kélè kàn 'two pieces of wrapper'
two CL wrapper

-
- | | | | | | |
|-----|-----|------|---------|--|-------------------------|
| b) | bàà | pél | kàn | | ‘two pieces of wrapper’ |
| | two | CL | wrapper | | |
| 9a) | enè | nvín | kòò | | ‘one chick(en)’ |
| | one | CL | hen | | |
| b) | enè | kà | kòò | | ‘one chick(en)’ |
| | one | CL | hen | | |

Syntactically, mass and count noun distinction (as found in English) is not recognized in Gokana. The classifier system in the language neutralizes this distinction. Both mass and count nouns are enumerated with classifiers, as in:

- | | | | | |
|-----|-----------------------|----|---------|---------------------------|
| 10. | bàà | kà | múú | (mass noun + classifier) |
| | two | CL | water | |
| | ‘two bodies of water’ | | | |
| 11. | bàà | kà | gè | (count noun + classifier) |
| | two | CL | machete | |
| | ‘two machetes’ | | | |

By contrast, in a non-classifier language with mass/count noun distinction, only mass nouns can take measure words that alternate for classifiers in such systems (e.g. two cups of tea not *two tea; three glasses of water not *three water). Count nouns do not co-occur with any measure word in such systems (e.g. two chairs; three books, etc.).

Number distinction is also determined by the classifier system in Gokana. There is no singular/plural alternation. This explains why in a noun phrase without a classifier a noun may alternate between a singular and plural interpretation, as in:

- | | | | | | |
|------|-------|-----|-----|------|-----------------------|
| 12a) | Ledum | beè | mòn | ból | ‘Ledum saw a goat’ |
| | PN | Pst | see | goat | |
| b) | Ledum | beè | mòn | ból | ‘Ledum saw the goats’ |
| | PN | Pst | see | goat | |

But if a numeral classifier is found in the noun phrase, the noun will have a singular or plural reading depending on the number contrast of the numeral classifier, as in:

- | | | | | | | | |
|------|-------|-----|-----|-----|----|------|-----------------------|
| 13a) | Ledum | beè | mòn | enè | kà | ból | ‘Ledum saw a goat’ |
| | PN | Pst | see | one | CL | goat | |
| b) | Ledum | beè | mòn | bàà | kà | ból | ‘Ledum saw two goats’ |
| | PN | Pst | see | two | CL | goat | |

Another interesting syntactic feature of the Gokana classifier system is that classifiers are obligatory in questions that seek to know the quantity of things, as in:

-
- 14a) Kuù kà kpòté ní e Ledum zálí é?
 QW CL chair FC that PN buy Emp
 ‘How many chairs did Ledum buy?’
- b) Kuù bób sà ní e Ledum mon é?
 QW CL broom FC that PN see Emp
 ‘How many brooms did Ledum see?’

These questions cannot occur without a classifier. This explains the ungrammaticality of (15a) and (15b):

- 15a) *Kuù kpòté ní e Ledum zálí é?
 QW chair FC that PN buy Emp
- b) *kuù sà ní e Ledum mon é?
 QW broom FC that PN see Emp

The classifier **kà** has the highest syntactic distribution in the Gokana classifier system. It can co-occur with all count nouns, whether animate or inanimate. It also occurs with mass nouns. **kà** is considered to be a grammatical or function-based classifier as there is no affinity between the meaning of the classifier and the classified in most of its usage. This classifier has grammaticalized in the Gokana classifier system. McGregor (2009:286) sees grammaticalization as a process by which a lexical category becomes a grammatical item. Hopper (1991:17) also asserts that grammaticalization is “the attribution of a grammatical character to a previously autonomous word”.

Thus, the classifier **kà** along with the classifiers **ból** and **té** have undergone the grammaticalization process of desemanticization. Heine and Reh (1984:17) state that desemanticization is a grammatical process whereby a lexical item receives a non-lexical function. The occurrence of the desemanticized item does not imply that the affected lexical item obligatorily disappears. It is possible for both the desemanticized item and the original item to co-exist. But whereas the desemanticized item is a grammatical morpheme, the original item remains a lexical morpheme. To illustrate this claim, the classifier **ból** is used to count round and seed-like objects as in (16):

16. vòò ból bèè ‘five pears’
 five CL pear

But **ból** can also be used to enumerate songs, as in:

17. vòò ból sól ‘five songs’
 five CL song

The classifier **ból** and the noun **sól** ‘song’ share nothing in common semantically as songs are not round and seed-like objects. Thus, we can only syntactically establish a functional link between the classifier **ból** and the noun **sól** ‘song’ through the grammatical process of desemanticization.

A similar analysis is applicable to the classifier **té**. The classifier **té** is used to count objects which are long and straight, especially wooden objects that could be used for transportation, as in:

18. taà té faà 'three canoes'
three CL vehicle

But **té** can also co-occur with a noun like **náa** 'gun', as in:

19. taà té náa 'three guns'
three CL gun

In this usage, **náa** 'gun' is not classified according to its semantic features, but rather it is classified based on syntactic function. The classifier **té**, in this case, functions as a desemanticized classifier. Ikoro (1994:19) makes a similar observation for Kana.

From the grammaticalization process, it is attested that numeral classifiers are usually derived syntactically from words used as names of concrete, discrete and moveable objects.

3.3 Semantic Structure of the Classifier System

Senft (2008:30) asserts that classifier systems typically involve twenty or more classifiers (i.e. separate lexemes that co-occur with the noun). He claims that one hundred classifiers are common, and four hundred are attested. Apart from the grammaticalized classifiers, classifiers are always free lexical items that occur in the same noun phrase as the noun they qualify.

The classifier and the classified must share certain semantic features. Most classifiers are based on the shape of the enumerated noun. Adams (1986:246) observes that shape is the major organizing principle in the classifier systems of most languages. Thus, in Gokana the obvious semantic criterion for assigning many classifiers to particular nouns is the shape of the noun. For instance, a classifier that has a round or seed-like shape can only co-occur with nouns of similar shape as the classifier and the classified must share a common shape. Here are a few examples illustrating the semantic relationship between a classifier and the enumerated noun in Gokana:

20. The classifier **kum** has a bunch-like interpretation, thus it is used to count bunch-like objects, as in:

- a) vòò kum bèè 'five bunches of plantain'
five CL plantain
- b) bàà kum gyoo 'two bunches of palm-fruit'
two CL palm-fruit

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Saving the Yorùbá Counting System from Extinction

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The objectives of this study are to determine whether secondary school students in some selected secondary schools in the Yorùbá-speaking areas of Nigeria know and use the Yorùbá numerals and currency in social interactions and also to determine their attitudes towards the teaching and the use of Yorùbá numerals and currency at the secondary school level. The sociology of language approach is adopted as the research methodology. This entails the use of questionnaire forms and participant observations. Three hundred students were sampled from selected secondary schools with the quota sampling frame. The data collected were analyzed using pie chart. It is discovered that secondary school students did not know and use the Yorùbá counting system in social interactions. It is therefore suggested that certain measures such as debates, prize-giving, award of scholarships, the review of Yorùbá scheme of work and the inclusion of numerals in examination questions among others must be considered by governmental and non-governmental agencies to save the Yorùbá counting system from extinction.

Key words: Attitude, Currency, Curriculum, Language use, Numerals, Teaching.

Introduction

Research studies, which show the grammatical descriptions of the Yorùbá counting system, can be divided into two groups. The first group comprises studies which show how smaller numerals, especially numerals 1 – 20 can be handled. For example,

1. 'oókan, òkan and ikan' (one)
2. 'eéjì, èjì' (two)
3. 'ẹẹta, ẹta' (three)
4. 'ẹẹrin, ẹrin' (four)
5. 'aárùn- ún, àrún' (five)
6. 'eéfà, èfà' (six)

For further detail, see Bowen (1858:47-50), Ward (1952:157-158) and Bamgboṣe (1967:14-17). On the other hand, Èkundayọ (1977:436-453), who belongs to the second group, argues that the information provided by previous studies on the Yorùbá counting system is inadequate. Èkundayọ (ibid) identifies the limitations of the previous studies and shows how any number, however complex it may be, can be handled in the Yorùbá numeral derivational morphology. He also shows how complex the Yorùbá counting system is. According to him, if 19,669 (Nineteen thousand six hundred and sixty nine) is taken as an instance, it can be described in the Yorùbá numeral derivational morphology as follows:

1(a) ọkẹ kan ó dín irinwó ó lé oókàndínlààádòrin
 $((20,000 \times 1) - 400) + ((80 - 10) - 1) = 19,669$

(b) òké kan ó dín òódúnrún ó dín oókànlélogbòn

	$((20,000 \times 1) - 300) - ((30 + 1))$	= 19,669
(c)	èédégbàáwá ó lé ẹgbẹ̀ta ó lé oókàndínlǎàádòrin $((20,000 - 1,000) + 600 + ((80 - 10) - 1))$	= 19,669
(d)	èédégbàáwá ó lé èédégbẹ̀rin ó dín oókànlélògbòn $((20,000 - 1,000) + (800 - 100) - (30 + 1))$	= 19,669
(e)	èédégbàáwá ó lé ọ̀tálélẹ̀gbẹ̀ta ó dín oókànlǎ $((20,000 - 1,000) + (600 + 60) + 9)$	= 19,669
(f)	èédégbàáwá ó lé ọ̀tálélẹ̀gbẹ̀ta ó lé mèsàn-án $((20,000 - 1,000) + (600 + 80) - 11)$	= 19,669
(g)	òkẹ kan ó dín ọ̀tálénírinwó ó lé mèsàn-án $((20,000 - 1,000) - (400 - 60) + 9)$	= 19,669

(For more information on the Yorùbá numeral derivational morphology, see Èkundayo (1977:436-453)).

1.2 Statement of the Problem

Several attempts have been made to describe the grammatical structures of the Yorùbá language for pedagogical reasons (see Crowther, 1852, Bowen 1858, Ward 1952, Delano 1965, Bamgboṣe 1967, 1990, Èkundayo, 1977, Awobuluyi 1978). Some of the grammatical components of the Yorùbá language which have received attention and which are taught and learnt in schools are Yorùbá numerals and Yorùbá currency. However, since Nigeria is a British Colony, English, which is the official language, is also learnt in schools and used in social interactions. The purpose of this paper is to find out whether the interference of English with Yorùbá has a positive (facilitation) or a negative (interference) effect on the language.

The main objectives of this study are to investigate the patterns of choice of Yorùbá numerals and currency by secondary school students and to examine their attitudes towards the teaching and use of either the Yorùbá or English numerals and currency at the secondary school level.

1.3 Research Hypotheses

Three hypotheses are advanced and they are as follows:

- Ho¹ Secondary school students know and use Yorùbá numerals in their speech in social interactions.
- Ho² Secondary school students know and use the Yorùbá currency in their speech in social interactions.
- Ho³ Secondary school students' attitudes are positive towards the teaching and the use of Yorùbá currency and numerals at the secondary school level.

2. Some Related Works

Studies on language use and language attitudes in Nigerian languages and English are common in sociolinguistic literature (see Èkundayo, 1987, Goke-Pariola, 1987, Oyeşakin, 1992, Awonusi, 1993, Babajide, 2001, Oyetade, 2001, Adegbite, 2004, Owolabi, 2007). Three conclusions can be drawn from these studies. First, English has

suppressively interfered with Nigerian Languages. Second, the results of the studies show that Nigerians, especially, Igbo, Yorùbá and the minority language speakers prefer English to any of the Nigerian languages as the official language in Nigeria. Third, researches that produce this result had either been conducted among the University undergraduates or among the literate people which form less than 20% of the Nigerian population and they concluded that the opinion of this class of people is the opinion of all Nigerians.

In the area of language use, Ekundayo (1987:5-13) claims that English has suppressively interfered with Yorùbá. According to him, the Yorùbá counting system is now being rejected for the English counting system. The study shows that instead of ‘èḍégbèta’ (five hundred), for example, what modern Yorùbá speakers now know and use is ‘ògórùn-ún márùn-ún’. We want to add that this language use is more common with the illiterate speakers of the Yorùbá language and that the literate speakers adopt this language use only in their interactions with the illiterate speakers in business transactions. In most cases, the literate speakers adopt the English equivalent of the Yorùbá counting system. One would hear them say ‘two hundred’ ‘three hundred’ ‘one thousand’, to mention just a few, in their Yorùbá speech. We also want to add that names of those whose Nigerian currency notes are named after are also used especially by the illiterate in social interactions or business transactions. For example, instead of ₦20.00 or ₦40.00, they often say ‘Muri kan (₦20.00) or ‘Muri méji’ (₦40.00). The term ‘Muri’ is the shortened form of the name of the former Nigerian Head of State – General Murtala Mohammed.

In the area of language attitudes, Babajide (2001), Oyetade (2001), Adegbite (2004) and Owolabi (2007) also claim that Nigerians, especially, the southerners prefer English to Nigeria languages. They argue that the southerners encourage the use and study of English at the expense of the Nigerian languages. However, while Adegbite (2004) argues that with enlightenment programmes, Nigerians’ negative attitudes to Nigerian languages can be checked, Owolabi (2007) admonishes that the Yorùbá should wage a war against the non-use of the Yorùbá language. While we agree with Adegbite (2004) that enlightenment programmes will help correct some misconceptions about the use of Nigerian languages, we want to add that it is important to put in place some measures by Governmental and Non-Governmental agencies that will help promote the teaching and the use of the indigenous counting system or languages. Similarly, the call by Owolabi (2007) may also amount to an academic exercise if the call is not backed up by government policy. Unless this is done, no matter how sound arguments in support of the use of the Nigerian language are, it will die a natural death just as the laudable attempt made by Fafunwa *et al* (1989) on the use of Yorùbá for all subjects in the 60s died a natural death. We are of the opinion that by now, if Fafunwa’s (ibid) Yorùbá project has received support from the then and succeeding governments in Nigeria, Nigeria or Yorùbá nation would have been competing favourably in the areas of science and technology with countries like Japan, Germany and South Korea, to mention just a few.

Furthermore, a major issue of interest in the study of bilingualism is language choice. A bilingual is a person who is competent in the use of more than one language. One of the sociolinguistic studies on language choice, which is relevant to our present

study, is Ure's (1979:263-283) study of language use and socialization in a multilingual community in Ghana. The research work focuses on language use or choice among primary school teachers in Ghana. It argues that English and Ghanaian languages exist side-by-side. According to the study, there are two language groups: the bilinguals who are primary school teachers who live in the villages and who will not use English in their homes and the bilinguals who are in the cities who do otherwise. Apart from educational matters for which the study reports preference for English, because textbooks are written in English, Ghanaian languages are mostly used for religion, sports, transport and recreation.

There are two major reasons that one can advance on Ure's (ibid) claim for a higher preference for the local languages. One major reason responsible for this show of loyalty to the local languages is that the groups studied have common linguistic background. Since there are no strangers among the groups studied, there is an inclination for the people to use their mother-tongues more frequently than English. One other reason is that the locality, which is sub-urban, places the use of the mother-tongues in a better position because majority of the people, if not all, who use the local languages are either illiterate or find it easier to express themselves in their mother-tongues for certain reasons. The deduction we can make from Ure's (ibid) claim is that, in any bilingual or multilingual society, the study of a bilingual's choice of words or language in relation to topics is important. It is the study of the languages in relation to topics that will show which among the languages is used for which topic. We agree with this position and the reviewed works will serve as the background for the present study.

3. Data Collection

This section describes the method and procedures used in the design and collection of data. The study adopts the descriptive survey design in order to find out whether secondary school students know and use the Yorùbá numerals and Yorùbá currency in social interactions. We shall also find out whether secondary school students prefer the teaching and use of Yorùbá numerals and currency to the English numerals and currency at the secondary school level. Three hundred (300) students were randomly selected from some schools that offered the Yorùbá language as a subject in Oşogbo – the capital of Oşun state. The secondary schools where the students were randomly selected were GOF International School, Good Tidings Educational Institute, St. Charles' Grammar School, Fakunle Comprehensive High School and Anglican Grammar School. GOF International School and Good Tidings Educational Institute are private schools while St Charles' Grammar School, Fakunle Comprehensive High School and Anglican Grammar School are public schools. A questionnaire was then designed to obtain information on the Secondary School students' use of language as well as their language attitudes.

The questionnaire had three sections. Section one was meant to obtain information on personal data such as level of education of the respondents. Section two, which was divided into two parts, was designed to elicit information on the Yorùbá lexical items. The first part was on the identification of Yorùbá numerals. The second part dealt with Yorùbá currency. Section three of the student's questionnaire,

which was on language attitude, sought to find out the respondents' feelings or attitude towards the teaching and use of the Yorùbá lexical items at the secondary school level. The Likert format is followed thus:

1 ----- strongly agree, 2 ----- agree, 3 ---- disagree, 4 ----- strongly disagree.

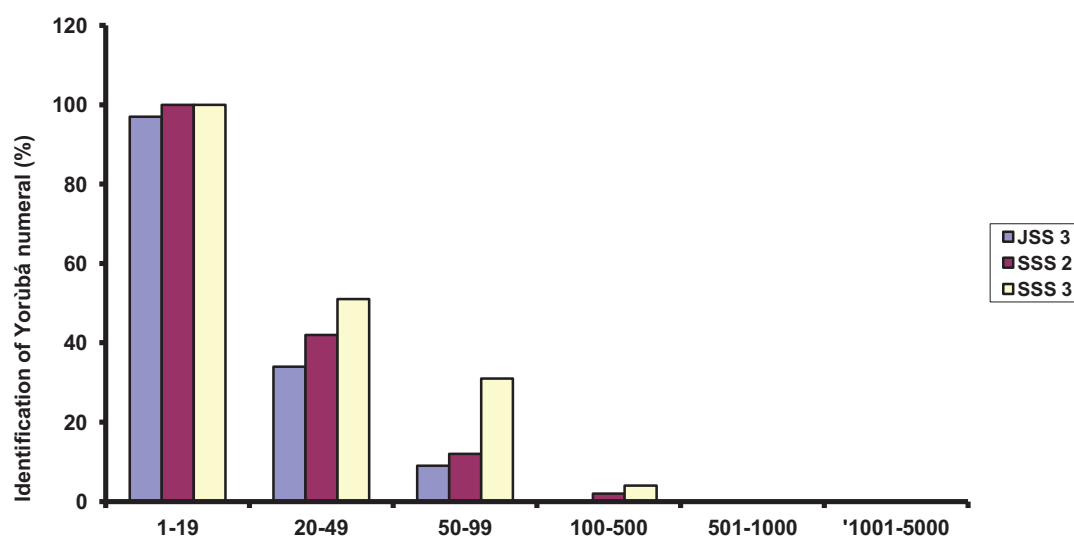
The respondents were to tick the appropriate columns provided, to indicate their level of agreement to each question.

Due consultations were made with the school authorities concerned. The questionnaires were given to the students to fill in each of the schools. The researchers collected all the questionnaires filled through the Yorùbá language teachers on the same day in each of the schools. All the 300 questionnaires were retrieved. Some of the students and the Yorùbá language teachers were interviewed. We also consulted the Yorùbá syllabus and the Yorùbá scheme of work that were approved by both the Federal and State Ministries of Education. The syllabus and the scheme of work are used by the Yorùbá teachers in the schools. This study is concerned with the opinions of students who speak both English and Yorùbá. The study is based on the behaviourist theory which says "if an act is followed by a satisfying stage of affairs, the probability of its occurrence in a similar situation is increased". In this paper, we shall show that the Yorùbá numeral system is facing the phenomenon of extinction because there are no stimulus and reinforcement for it. The statistical method used for the data collected was based on the *Pie Chart* analysis.

3.1 Findings

The distribution of responses is shown in Graphs 1-7. For example, there are a number of observations from the distribution of responses as shown in Graph 1 below.

Graph 1: Identification of the Yorùbá numeral one to five thousand by the secondary school students in some selected secondary schools in Oşogbo



The first observation from the figure shows that the majority of the JSS3 students claimed to know the numerals 1-19 while a few claimed to know numerals 1-49. For example, 97% of the JSS3 students claimed to know numerals 1-19, 35% knew

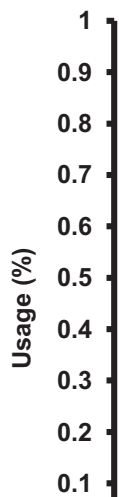
numerals 1-49 and 9% indicated that they knew numerals 1-99. Although, none of the JSS3 students could claim the knowledge of numerals 100-5000, in social interactions, we still had very few students who claimed the knowledge of numerals such as 300, 400, 500 and 1000.

Information from the Graph also shows that none of the SS2 students knew all the Yorùbá numerals 1-5000. The only information we had was that the greater the numeral the fewer the number of students who knew it. For example, while the hundred students that were interviewed knew numerals 1-19, 42% of the students knew numerals 20-49. While 12% of the students knew numeral 50-99 only 2% knew numerals 100-500. Although, it was discovered in social interactions that there were some students who knew numerals like 501,600, 1000, none of the students knew all numerals 501-5000.

Similarly, apart from numerals 1-49 which majority of the SS3 students knew, the greater number of the students did not know numerals 50-5000. For example, all the 100 students knew numerals 1-19, 51% of the students knew numerals 50-99 and 4% knew numerals 100-500. None of the students knew numerals 501-5000. Based on this result, we have to reject the hypothesis that the secondary school students know the Yorùbá numerals 1-5000.

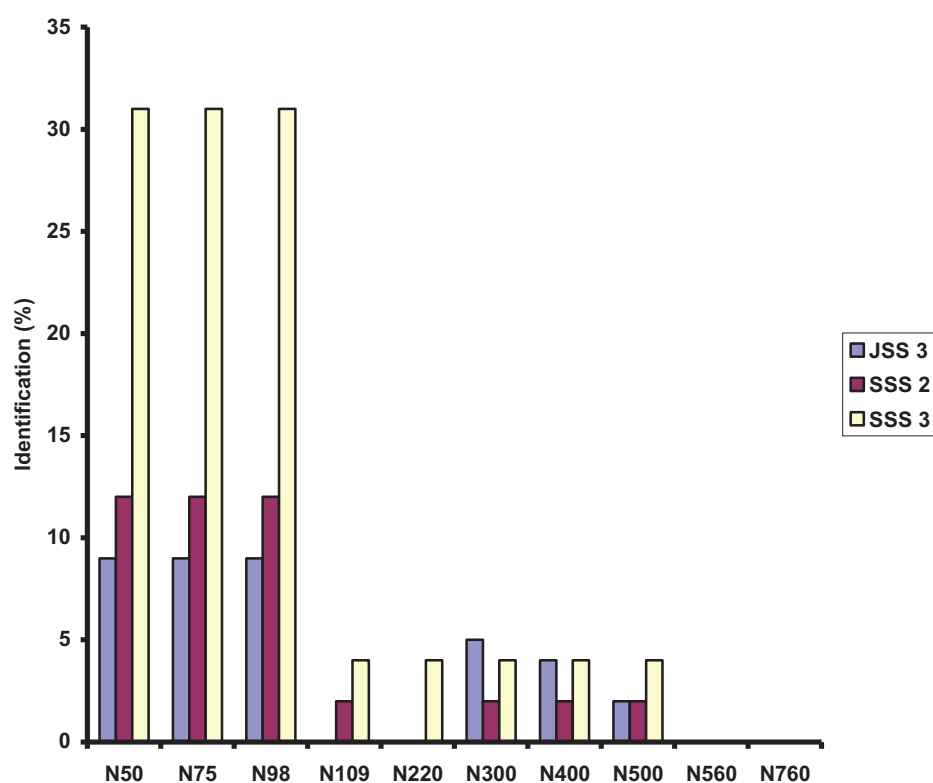
The information in Graph 2 below also shows that our hypothesis that secondary school students use Yorùbá numerals in their speech in social interactions must be rejected.

Graph 2: *Usage of the Yorùbá Numeral one to five thousand by the Secondary School Students in some selected secondary schools in Oşogbo*



From Graph 2 above, it will be observed that none of the secondary school students claimed to use the Yorùbá numerals in his or her words in social interactions. The information in Graph 3 addresses the question of the identification of Yorùbá currency by the selected students.

Graph 3: Identification of the Yorùbá currency by the secondary school students in some selected secondary schools in Oṣogbo – the Oṣun State capital

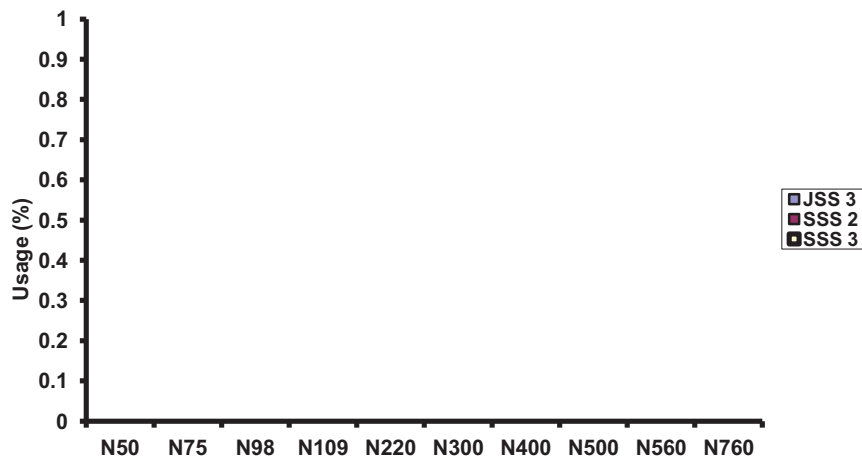


It can be observed from Graph 3 that the number of JSS3 students that could match some of the Yorùbá currency with their English equivalent was insignificant. For example among the JSS3 students, only 9% of the 100 students were able to match the Yorùbá currency of fifty naira, seventy five naira and ninety eight naira with their English equivalent. While only 5% of the JSS3 students could match the Yorùbá currency of three hundred naira with its English equivalent only 4% could match the Yorùbá currency of four hundred naira with its English equivalent. For the Yorùbá five hundred naira, only 2% of the students could match the amount with its English equivalent. What the case was with the JSS3 students was also the case with the SS2 students. The percentage of students that could match the Yorùbá currency of fifty naira, seventy naira and ninety eight naira with their English equivalent was 12% of the students while only 2% of the students could match the Yorùbá currency of one hundred and nine naira, three hundred naira, four hundred and five hundred naira with their English equivalent.

Among the SS3 students, the number of students who could match the Yorùbá currency in Graph 3 was a little higher than the number of JSS3 and SS2. However, the difference between the JSS3 and JSS3, SS2 put together cannot be said to be encouraging as majority of the JSS3 students could not match the Yorùbá currency with their English equivalent. For example out of the 100 students that were given questionnaire forms to fill only 31% of the students could match the Yorùbá currency of fifty naira, seventy five naira and ninety eight naira with their English equivalent while the number of students that could match each of the Yorùbá currency of one

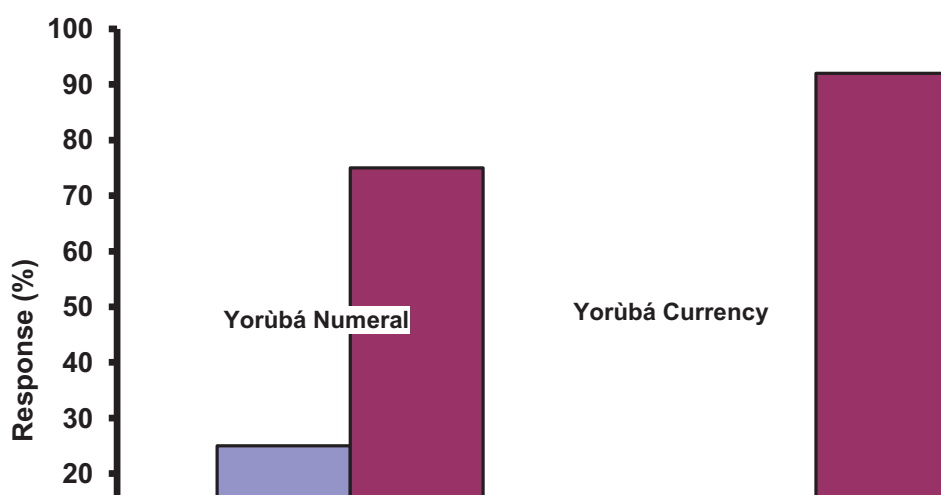
hundred and nine naira, two hundred and twenty naira, three hundred naira, four hundred naira and five hundred naira was just 4. However, Graph 4 examines the use of currency by the selected students in Oṣun State.

Graph 4: *Usage of the Yorùbá currency by the secondary school students in some selected secondary schools in Oṣogbo – the Oṣun State capital*



The result in Graph 4 shows that none of the secondary school students used the Yorùbá currency in his or her speech in social interactions. Graphs 5, 6 and 7 deal with language attitudes towards the teaching and the use of Yorùbá currency and numerals.

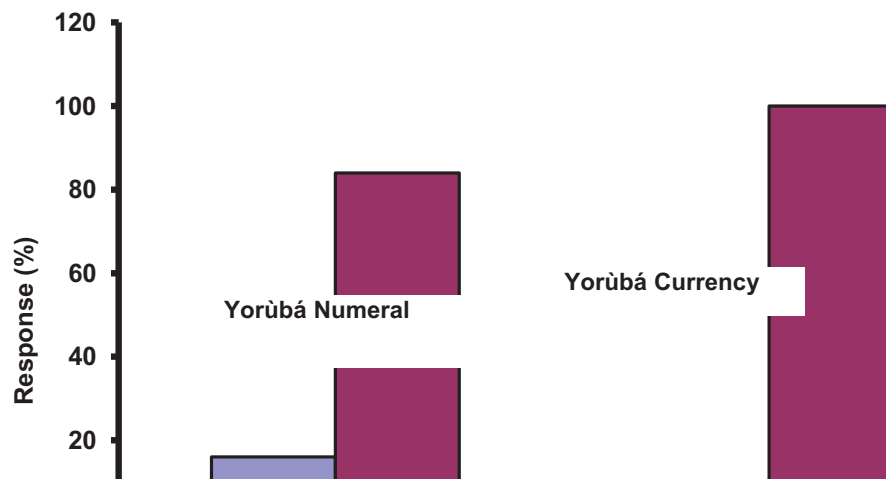
Graph 5: *Identification of the JSS3 students' attitudes towards the teaching and the use of Yorùbá currency and numerals in some selected secondary schools in Oṣogbo – the Oṣun State capital*



As shown in Graph 5 above, the JSS 3 students did not show much emotional attachment to the teaching and the use of the Yorùbá lexical items such as numerals and currency.

However, are the SS 2 and SS 3 students positively disposed to the teaching and the use of the Yorùbá lexical items in question? The answer to this question is shown in Graphs 6 and 7.

Graph 6: *Identification of the SS 2 students' attitudes towards the teaching and the use of Yorùbá currency and numerals in some selected secondary schools in Oşogbo – the Oşun State capital*

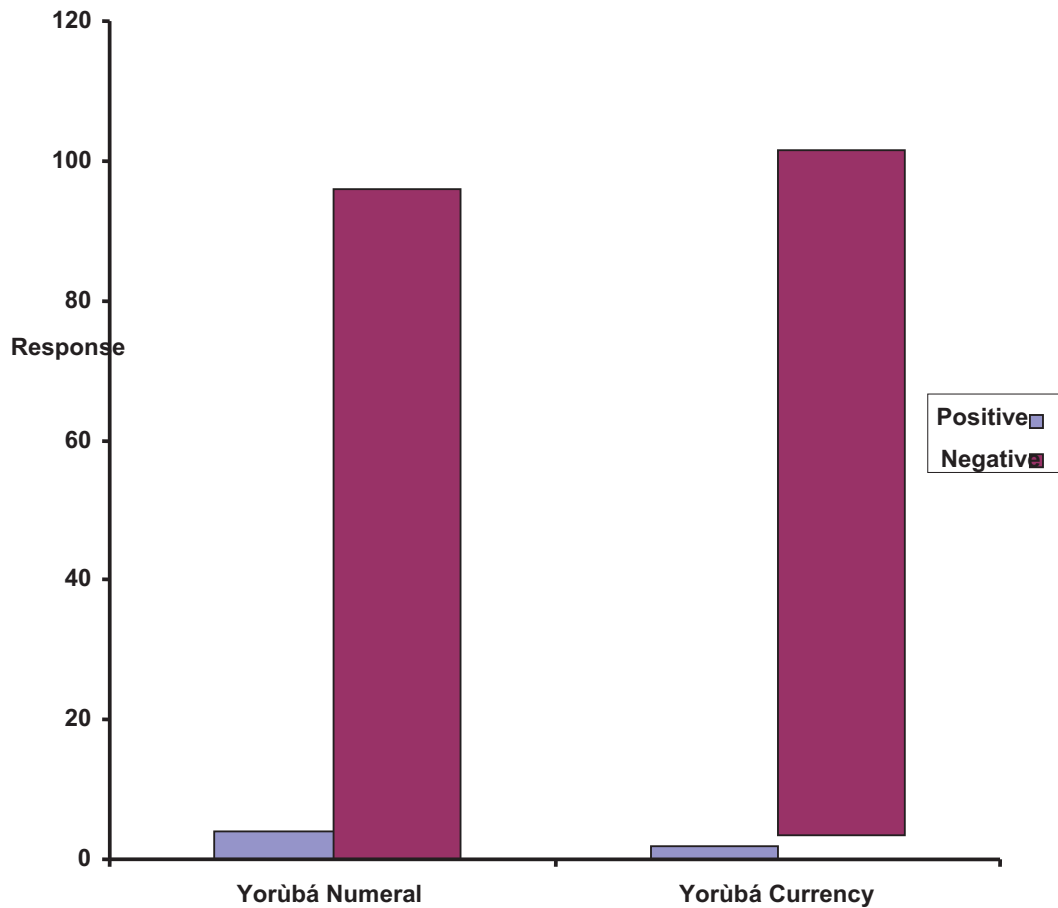


A critical examination of the information presented in Graph 6 above shows that the SS 2 students were not positively disposed to the teaching and the use of the Yorùbá lexical items in question. The majority of the SS 2 students preferred the teaching and the use of the English currency and numerals to that of the Yorùbá.

Similarly, the information in Graph 7 shows that the SS 3 students were not positively disposed to the teaching and the use of the Yorùbá lexical items in question.

A comparative study of the information in Graphs 5 - 7 shows that the higher the educational attainment, the greater the rate of indifference to the teaching and the use of the Yorùbá lexical items of numerals and currency.

Graph 7: *Identification of the SS 3 students' attitudes towards the teaching and the use of Yorùbá currency and numerals in some selected secondary schools in Oşogbo – the Oşun State capital*



4. Discussion

However, in our view, there are several reasons that may be responsible for the poor knowledge and non-use of the Yorùbá counting system as shown in Graphs 1 and 2. First, the Yorùbá scheme of work is too over-loaded. For example, three periods of forty minutes each are allocated to the teaching of Yorùbá per week. And Yorùbá is divided into three areas – literature, grammar and culture. According to the Yorùbá teachers, literature has a period, grammar has a period and culture has a period. One can say from the results in Graph 1 that smaller numerals that are emphasised as the time permits are known by the students.

Second, since members of the community in which the students live as well as their parents are either fairly literate or literate, they hardly speak or use the Yorùbá numerals. What was discovered from the information collected through the informal method was that the Hindu-Arabic numerals which English borrowed have suppressively interfered with the Yorùbá numerals and it was these numerals that the secondary school students knew and used in social interactions. For example, we heard them say 'mèjelélógún' ($20 + 7 = 27$) instead of 'ètàdínlògbòn' or 'mètàdínlògbòn' ($30 - 3 = 27$). One also hears twenty (20) instead of 'ogún' or

‘okòó’, ‘eighty’ (80) instead of ‘ogórin’, ‘one hundred àti mēwàá’ ($100 + 10 = 110$) instead of ‘àádófà’ ($120 - 10$), to mention just a few.

Similarly, in social interactions, it was observed that, in addition to the English equivalent, secondary school students called one thousand naira (₦1,000.00) one k or one g, two thousand naira (₦2,000.00) two k or two g, one thousand two hundred naira (₦1,200.00) one two (1,2), to mention just a few. The consonant ‘k’ is from the word kilogramme, the consonant ‘g’ is from the word gramme. However, this type of language use may not last. It may either become non-existent or be replaced by some other terminologies. In fact, this type of language use reminds one of the phrases that were introduced when Nigeria returned to democratic rule in 1999. The use of phrases or sentences like “Jẹun sókè” (Eat up), “Jẹun sápò” (eat inside your pocket) and “Go on sòhùn-ún” (Move on) were rampant. Today, these phrases or sentences are no longer used.

Third, that the Yorùbá numerals have not been designed to take part in scientific investigation might also be responsible for the secondary school students’ poor knowledge and non-use of the Yorùbá numerals. The Yorùbá numerals are not used for mathematical or scientific calculations such as fractions, multiplication, subtraction, addition and division in schools.

Our suggestions are, therefore, first, the Yorùbá curriculum planners should ensure the effective teaching of the Yorùbá counting system in schools since it is in the syllabus and at least a period per week per class should be allowed for the teaching of the Yorùbá counting system. In fact, this aspect of the Yorùbá language should be seriously emphasised because of its relevance to the development of science and technology. Second, we observe that in the early 60s, examination bodies like West African Examinations Council (WAEC) used to set questions on Yorùbá numerals. However, in recent times, this laudable aspect has been done away with. We are of the opinion, therefore, that the examination bodies should go back to their earlier practice. In fact, because of the relevance of calculation to the modern age, we suggest that 35% of the Yorùbá questions at both the Junior and Senior secondary school levels should be devoted to our indigenous counting system.

Third, Yorùbá Studies Association of Nigeria should always advise State and Federal governments on the importance of the indigenous counting systems to the challenge of modern technological advancement or development as well as the need to continue to embrace it. The news broadcasters can also help in the promotion and use of the indigenous counting systems through the various electronic media. The various governmental and non-governmental organizations should organize debates and competitions on the indigenous counting systems and those that perform excellently well should be awarded scholarships. This will motivate others. It will also complement the efforts of the Western State of Nigeria, Federal Government of Nigeria and UNESCO in their desires to design and standardize an acceptable orthography for the Yorùbá language in the 60s and 70s.

Furthermore, countries like Japan, Germany, South Korea, China, to mention a few, that have succeeded technologically, have made use of their counting systems in their local languages. Therefore, if the clamour for the development of technology will succeed in Nigeria, our local counting system should be encouraged and used since it

comprises addition, subtraction, division and multiplication. It is also important to note that most Nigerians use the English equivalent of the counting system because the teaching of the local counting systems normally stops at the secondary school level. We are, therefore, admonishing the governments and the management of our tertiary institutions to expand their curriculum to include the teaching of the local counting systems.

Two factors may be advanced for the results in Graphs 3 and 4. The factor of colonialism may be blamed for the secondary school students' poor knowledge and non-use of the Yorùbá currency. Before Nigeria became a British Colony, the Yorùbá currency that was in use was 'owó ẹyọ' (cowries) or 'iyeó'. Everybody, irrespective of his or her age, knew and used the currency in social interactions. But, when Nigeria became a British Colony, 'owó ẹyọ' (cowries) or 'iyeó' was replaced with the British pounds and shillings. In fact, a comparative study of the counting systems under 'owó ẹyọ' (cowries) or 'iyeó' and the British pounds and shillings will show that the indigenous counting system under 'owó ẹyọ' (cowries) or 'iyeó' is simpler than that of the British system.

Government policy is another factor which may make the Yorùbá currency to face the phenomenon of extinction. When the Federal Government of Nigeria replaced the British pounds and shillings with naira and kobo, it had to adopt the Hindu-Arabic number because of the multilingual nature or composition of Nigeria. At present, the currency notes that are used in the Country are N5.00, N10.00, N20.00, N50.00, N100.00, N200.00, N500.00 and N1000.00. It is not only the secondary school students that use the government approved currency notes, literate and illiterate speakers of the Yorùbá language also use it. We can therefore say that any aspect of a language that is not used by its speakers may cease to exist no matter the effort of any group of people to ensure its survival.

It will be recalled also that when Nigeria became a British colony, the Yorùbá words for the British currency included 'tóró' (three pence), 'sísí' (six pence), 'nàín' (nine pence), 'şìlè' (shilling), and 'pón-ùn' (pound). However, the use of this currency did not continue because Nigeria changed from the British currency to naira and kobo system. Now that the country is back to the old counting system or the integer system, it is important for the country, especially the Yorùbá speakers in the country, to demonstrate once more their mathematical prowess and exhibit what is native to them. In fact, the Federal Government of Nigeria, during Obasanjo regime, realised the importance of the Nigerian counting system and allowed the Nigerian equivalent of the numerical system to appear on some Nigerian currency notes. For example:

<i>Hausa</i>	<i>Igbo</i>	<i>Yorùbá</i>	<i>English</i>
Naira biyar	Naira ise	Naira márùn-ún	five naira
Naira goma	Naira iri	Naira mēwàá	ten naira
Naira ashirin	Naira abuo	ogún naira	twenty naira
Naira hamsin	Naira iri ise	àádóta naira	fifty naira

However, the Nigerian currency notes of N100.00, N200.00, N500.00 and N1000.00 do not have the Nigerian equivalent. Therefore, first, the present government of Nigeria should continue where Ọbasanjọ stopped and ensure that these notes have the Nigerian equivalent. Second, the monthly allocation from Abuja to states, ministries and local government councils should be translated to the local currency system and read on the radio and television stations. It should also appear in the dailies. Third, the Federal government of Nigeria should ensure that manufacturers, within and outside Nigeria, should provide the Nigerian currency equivalent of their prices on their products to be sold in Nigeria. Fourth, churches and mosques should also help promote the use of the local currency. The present system whereby the English currency alone is used should stop. Both should be used.

It is also evident from the information contained in Graphs 5-7 that secondary school students' interest in the teaching and use of the English lexical items would make the teaching and the use of the Yorùbá lexical items to be grossly unpopular among them. It has also been argued in this paper that government policies in a multilingual community may be responsible for the secondary school students' negative attitudes towards the teaching and the use of the Yorùbá currency and numerals. However, as it has already been shown, the negative attitudes can be checked if the suggestions advanced are considered and embraced.

5. Conclusion

In this paper we have investigated the patterns of choice and use of the Yorùbá lexical items such as numerals and currency as well as the secondary school students' attitudes towards the teaching and the use of the Yorùbá currency and numerals instead of their English equivalent. It was discovered that majority of the secondary school students did not know and they did not use the Yorùbá currency and numerals in social interactions. It was also discovered that the secondary school students' attitudes towards the teaching and the use of the Yorùbá currency and numerals at the secondary school level were not positive enough to ensure a safe future for the currency and numerals.

Furthermore, it was argued that colonialism, government policy and the non-use of the Yorùbá numerals in mathematical or scientific calculations especially in business transactions because of the multilingual nature of Nigeria might be responsible for the secondary school students' negative attitudes to or poor knowledge of the Yorùbá numerals and currency. Therefore, in view of the importance of the indigenous counting system, it is recommended that certain measures must be taken to address the poor knowledge and non-use of the Yorùbá counting system.

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The Derivational Processes in the Zarma Numeral System¹

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This paper examines the numerical system of Zarma. Attempt is made, here, to first identify the canonical structure of the various numerals in Zarma. This is followed by an analysis of the derivational processes evident in this numeral system developed and used by Zarma native speakers. Basically, the paper brings to the fore the various categories of numerals generated in Zarma vis-à-vis their idiosyncratic morphological and phonological processes exploited by the language in the production of assorted numeral forms. Phonologically, processes such as elision, and sometimes reduplication occupy centre stage in the derivation of values of different numerical quantities, while affixation and ²compounding are the morphological operations exploited in the formation of hierarchical ranking of the numerals. However, some figures are produced via an interplay of some morphological and phonological processes.

1. Introduction

This paper seeks to examine the numeral system of Zarma and the linguistic properties exploited by the language in the various derivational processes that underlie this system. Two tasks are carried out in this connexion: first, an attempt is made to make bare the canonical numerical system of the language and second, a linguistic analysis of the underlying derivational processes that characterize these configurations is established, thereafter. Crucial to the various derivational patterns are morphological and phonological operations that generate numbers of different quantities, magnitudes and dimensions. Basically, Zarma has a bipartite numerical set up: cardinal and ordinal. However, an additional derived systems of multiples and distributive forms are further identified. However, with the exception of the cardinal ones, most of the numerals exploit morphological and phonological processes in deriving various counting systems. Phonological processes such as elision, reduplication and vowel lengthening are productively used by the language. Also, morphological processes that include affixation and compounding are evidently central to some derivational patterns. This does not, however, preclude a combination of the phonological and morphological operations in this numerical mechanism. However, for ease of exposition and discussion the rest of the paper is structured along the following dimensions. An outline of linguistic profile of Zarma is provided in section 1.1. Section 2 deals with the major numerical systems employed in the language: cardinals and ordinals. Here, the various numerical formations and possible combinations are presented and discussed. The third segment of the paper (section 3), considers the derived number patterns that characterized the multiple system and the distributive

¹ My sincere gratitude is due to my former student, Zainab Almustafa; and her mother, Malama Sa'adatu Suleman, the Headmistress of Yahaya Abdulkarim Model Primary School, Sokoto, who served as my informants over a long period of time. They have provided me with most of the data on which this work hinges and are patient and generous enough to respond to my questions.

numerals. A close scrutiny of the various derivational processes canonical of Zarma numerals is also considered both in the second and third segments of the paper. We conclude our discussion in 4.

1.1 An Outline of linguistic Profile of Zarma

Zarma is one of the major important Songhay speech varieties, variously referred to as *Dyarma*, *Dyabarma*, *Zabarma*, *Adzerma* and *Zabarna*. It is subsumed under the larger grouping of Songhai language family. However, it is a tonal dialect of Songhai dialect cluster (with Songhai and Dendi). It is, generally, assumed to be unrelated to any other known language or language group. Greenberg (1963) takes it to be a part of the Nilo-Saharan language family. It is further classified as Congo-Kordofanian. The Zarma people are found scattered in various sub-regions of Africa, particularly, predominantly in West Africa. More specifically, a large concentration of the speakers are located in the Westernmost part of Niger Republic; other reasonable number of speakers are found in adjacent areas of Burkina Faso, Mali and Nigeria, with few speakers living in urban areas of Northern Ghana (Crimes; 1996). The language is called Zarma by the native speakers in Nigeria, Benin and Burkina Faso, but Zarmaci in Mali (Crimes, *ibid*). In Nigeria, Zarma speakers are predominantly found in Sokoto, Kebbi and Zamfara states, where the language is spoken as one of the major indigenous languages.

Zarma has a simple tonal system that comprises of four tones: high, low, fall and rise. The language, essentially, is characterized by SOV word-order configuration. Let us now explore how the numerical system is organized.

2. The Numeral System

Zarma operates a decimal numeral system. There are lexical items representing number 1 to 1000, characterized by various possible combinations that exploit the cardinal numerical resources to build up an increasing system of counting by means of productive additive mechanism. However, the overall numerical system is a product of an interplay of morphological and phonological processes employed to derive various numerical entities of different quantities and magnitudes.

Three basic numerical systems are identified thus: the Cardinal, Ordinal, and a derived system of multiples and distributive numerals. These counting structures are lexicalized in the language. They are, also, in turn a function of specific linguistic operations alluded to above. We present and analyze these numerical systems in due course. Let us begin our discussion by identifying the cardinal numerals that constitute the basic figures.

2.1 The Cardinal System

The basic cardinal numbers from one to ten are lexically represented as follows:

A) *The Cardinals*

1	=	àhò
2	=	ihínkà
3	=	ihínzà

4	=	ítàkì
5	=	ìgù
6	=	íddù
7	=	íyyè
8	=	àhàkkù
9	=	‘yàggà
10	=	ìwái

The cardinals can be further subcategorized into two based on their linguistic behaviour when used in conjunction with any tens to form numbers such as 11, 12, 13, 14, 15 etc: numbers 1-5 are prone to initial vowel deletion and consonant weakening elsewhere. On the contrary, no change occurs with respect to 7-10 except that 6 and 7 undergoes certain phonological changes, specifically in respect of the formation of 60 and 70. We now turn to the counting system that combine these cardinals with the stem numeral *ìwái* signifying 10 in conjunction with the word *kindi* to yield derived numerals: 11, 12, 13, 14, 15, 16, 17, 18, and 19. Elsewhere *kindi* means reminder; but in this context it connotes either *with*, *along side* or *side by side with*. The numerals 1 to 19 are given below:

B) *Derived Numerals: 10 combined with the Cardinals*

wai kindi hoo	=	11
wai kindi hinka	=	12
wai kindi hinza	=	13
wai kindi taaki	=	14
wai kindi guu	=	15
wai kindi idduu	=	16
wai kindi iyyee	=	17
wai kindi ahakkuu	=	18
wai kindi ‘yaggaa	=	19

A closer look at the above reveals the following. First and foremost, the entire numerical organization is a function of compounding. However, this process generates certain phonological processes that include vowel elision word-initially that affects *ìwai* shortened to *wai* and the cardinals 1 to 5, also word-initially (i.e., 11 to 15 above). However, in the case of the numerical forms 17, 18 and 19 there is no deletion, rather what we notice is vowel lengthening, word-finally in the derived compound figures, specifically with respect to the cardinals 7, 8 and 9 in the respective numbers 17, 18 and 19. The next pattern of counting system to be discussed comprises numerals from 20 to 29. These are derived by combining the word *waranka* which stands for the figure 20 with the conjunct *kindi* and the relevant cardinals. These are presented below in their ascending order:

C) *The Derived Numerals: The Cardinals Plus the Stem Numeral 20*

waranka kindi hoo	=	21
waranka kindi hinkaa	=	22
waranka kindi hinzaa	=	23

waranka kindi taakii	=	24
waranka kindi guu	=	25
waranka kindi idduu	=	26
waranka kindi iyyee	=	27
waranka kindi ahakkuu	=	28
waranka kindi oyaggaa	=	29

The above paradigm represents yet another interesting numerical pattern that involves complex derivational process. It is noteworthy that word *waranka* signifying ‘20’ is derived from the number stem *iwai* (i.e., 10) via some morphophonological processes made up of deletion and insertion of a word and suffixation operated on *iwai* as the root word number. First, the initial vowel of *iwai* is deleted this is followed by an affixation of the word *hinka*, meaning 20. Possibly the *-ihi-* gets deleted and replaced by *-ra-* word-medially, consequently, we have the word for ‘20’, namely, *waranka*. As for the rest of the numerical forms: 21 to 29, two processes are evident: initial elision of the vowel in the added cardinals 1 to 5 and vowel lengthening in the word-final positions of the cardinals in the lexical forms of the numbers 21 to 29.

Similarly, the lexical item *waranza* which represents ‘30’ can be shown to be derived from the stem number 10 with the lexical form *iwai* plus the suffix *hinza* denoting ‘3’ which equals literally three tens. This further submits to subsequent phonological processes of deletion and infixation. The initial and final vowels of *iwai* get deleted and part of the first syllable in *-hin-* gets elided and replaced by an infix *-ra-*. Generally, in all the cases of forming a numeral that yields multiples of tens, such as 50, 60, 70, 80, and 90, can be said to be a function of the identified linguistic operations in the preceding sections. The same processes in respect of the added cardinals that characterizes 21 to 29; 31 to 39; as well as 41 to 49, hold with regards to 51- 59, 61 – 69, 71 – 79, etc.

The number 100 is distinctively lexicalized as *zangu*. The ascending number system representing multiples of hundreds are derived by combining *zangu* as the number stem and the respective cardinals added to it to generate 200, 300, 400, 500, 600, 700, 800, and 900. This is captured in (4):

D) *Multiple of Hundreds*

zangu hinka	represents	200
zangu hinza	represents	300
zangu taki	represents	400
zangu gu	represents	500
zangu iddu	represents	600
zangu iyye	represents	700
zangu ahakku	represents	800
zangu ‘yaggu	represents	900

Note, however, that any number between 1 to 99 can in principle be added to produce a required figure by means of a conjunct *-nda*. *Zambara* is the lexical item for 1000. The same process exploited in the building of multiples of hundred are equally

productive in forming different quantity of thousands. In a nutshell, *zambara* constitutes the number stem combined with the cardinals *hinka*, *hinza*, etc to have multiples of thousand: 2000,3000,4000 and so on so forth. In the same fashion, any number from 1 to 999 can in essence be added to *zambara* through the use of the productive conjunct *-nda* to yield varying magnitudes of quantities so desired. The next major system to be considered is the ordinal one.

2.2 The Ordinal System

Zarma does not use separate set of ordinal numbers; rather the cardinal numbers are productively exploited in conjunction with *-nte*, suffixed to the cardinal numbers to mark different ranking. This is illustrated thus:

sângìnà/shìntiné	=	1 st
ihìnkànté	=	2 nd
ihìnzànté	=	3 rd
itákànté	=	4 th
ìggùnté	=	5 th
ìddùnté	=	6 th
ìyyànté	=	7 th
àhàkkùnté	=	8 th
‘yàggànté	=	9 th
ìwànté	=	10 th

As can be observed, with the exception of the ordinal representing 1st, which differ in significant ways from the rest of the ordinals in two respects, all the other ordinals are realized by means of the suffix *-nte*. The differences owes to the fact that the ordinal marking the first position is the only one that has free variants and does not end with the suffix *-nte*.

In fact *-nte* can be used to derive all other rankings in respect of all other numerals in the language. The basic operational principle is simply to add the suffix *-nte* word-finally to the numeral; its ordinal form would be derived. The main function of ordinal numerals in Zarma is to specify ranks within a hierarchy, i.e., to locate a noun referent in a particular hierarchical position. For instance, an ordinal number such as *ìyyànté* refers to an entity which is positioned as the seventh. In addition to the cardinal and ordinal counting system, Zarma has a rich distributive numerals and a system of deriving multiples. To these we now turn.

2.3 Distributive Numerals

Essentially, the distributive numerals in Zarma are derived from the cardinal ones, either through complete reduplication or partial one. In cardinals arranged from 1 to 10, the numeral can only be partially reduplicated in its distributive form with respect to the first five ordinals (1-5). Also in the derivational process, there is the occurrence of vowel deletion in the second segment of the reduplicated form. However, the reverse is the case in respect of the remaining ordinals 6 to 10. That is to say to derive

their distributive forms, the cardinals undergo complete reduplication and no vowel elision is involved. The following examples demonstrate these facts:

A. *Partial Reduplication:*

àhó-hóo	=	1-1	[one each]
ìhìnká-hìnká	=	2-2	[two each]
ìhìnzá-hìnzá	=	3-3	[three each]
ìtáki-táki	=	4-4	[four each]
ìgúu-gú	=	5-5	[five each]

B. *Complete Reduplication:*

ìddù-ìddù	=	6-6	[six each]
àhákkù-àhákkù	=	7-7	[seven each]
‘yàggà-‘yàggà	=	8-8	[eight each]
ìyyé-ìyyé	=	9-9	[nine each]
ìwaí-ìwaí	=	10-10	[ten each]

Some of the above distributive numerals are further used in sentences to show their distribution. The first sentence contains one of the first five cardinals; whereas the second one falls under the second set of the cardinals (i.e., 6-10).

7)a. ìmmà kóyân nó nàirá hó-hó
imperative marker children give naira one-one
‘give each child one naira each’

b. ìmmà kóyân nó nàirá ìddù-ìddù
imp marker children give naira six-six
‘give each child six naira each’

We have thus far discussed the distributive numerals; we shall consider next the multiples.

3.1 The Multiples/Times

The notion of times, as expressed by *once*, *twice*, *three times* in English is expressed by *ke*² immediately preceding a numeral in Zarma. This suffix can in principle be added to any number in word- final position to derive its multiple.

The following paradigm showcases the phenomenon of multiples in Zarma:

8) *Deriving the Multiples in Zarma*

ké hó	=	‘one time’ (once)
ké hìnká	=	‘two times’ (twice)
ké hìnzá	=	‘three times’ (thrice)
ké táki	=	‘four times’
ké gú	=	‘five times’
ké ìddú	=	‘six times’

ké	ìyyé	=	‘seven times’
ké	àhàkkú	=	‘eight times’
ké	‘yàggà	=	‘nine times’
ké	wài	=	‘ten times’

Two phonological processes are evident in the above data. First, there is the deletion of the first vowel across the board in all the following cardinal numbers. Second, there is tonal polarity in some of the formations, particularly, in respect of cardinals 2, 3, 6, 7, 8, 9, and 10. Again, even though vowel elision apply only in the cardinals 1 to 5, yet we witness the same operation in respect of cardinal 10, which falls within the subcategory of cardinals that are opaque to such operation. In the next section we shall take stock of what we have discussed so far.

4. Concluding Remarks

Thus far we have examined the nature of the Zarma counting system. An attempt is also made to bring to the limelight the different types of numerical system used by the speakers of the language and the various morphological and phonological processes exploited in the different formations of this numerical system. We have noted that, Zarma does not employ subtractive mechanism but rather productively uses the additive one via the additive entity *-nda*. We note that several morphophonological processes are involved in the derivation of the numerals. Prominent among these are vowel elision or deletion, reduplication, and vowel lengthening. We have not however discussed the issues of tone stability effect and tone modifications especially in the case of the cardinals when used to derive the multiples or elsewhere, where tonal modification is evidently seen. Since this is a pioneer work, these issues await further study.

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Compounding in the Yoruba Numeral System

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Yoruba employs various processes for compounding numerals. A number of works have discussed ‘numerals’, either as explanatory articles or as pedagogic articles for beginners/learners of the Yoruba language, others have also considered compounding as a syntactic process. A detailed systematic description of syntactic and phonological interactions that lead to numerical compounding is yet a feat to be achieved. A proposition of ‘relic-nouns’ (stilted nouns) that have survived in Yoruba over the years, form the root from which other numerals are derived. This paper also attempts a description of how deletion, contraction, assimilation as phonological processes interface with morphological processes in the derivation of compound numerals.

Keywords: Numerical compounds, cardinal numerals, ordinal numerals, adverbial numerals, numerical adjectives, relic nouns

1. Introduction

Long before the advent of both western/eastern education, Yoruba had already established their own mathematics in form of counting system. The conventional Arabic symbols [1, 2, 3..., etc.] came about as a result of foreign educational influences. The following proverbial sayings reflect the notion of arithmetic in Yoruba earlier experiences:

Eni bi eni lomode n kawo, eji bi eji lagbalagba n tayo. (*One-by-one the child counts money, two-by-twos the elders play game*).

Meloo la o ka ninu eyin Adepele? Tinu orun, tode ejo, ojilerugba lo fori mule laiyo. (*How many can we count in Adepele's teeth? Those inside are hundreds, those outside are eighties, and about two hundred and forty are sprouting in the root*).

The lexical items *eni*, *aji*, *ejo*, *orun*, *ojilerugba* are numerals respectively.

The purpose of this paper is to examine the internal structure of compound numerals in Yoruba. Some of the main concerns of the paper are: How are numerals compounded? How are more complex numerals built from simple words/morphemes? What are the basic building blocks in the formation of compound/complex numerals? How is the meaning of a compound/complex numeral related to the meaning of its component parts?

Many works have discussed “Onka Yoruba” as pedagogic articles for students of Yoruba, in as much as the topic is essential in secondary school curriculum. However, their description either focus on how the numerals are added, subtracted or multiplied to make a progression from untis to tens and thousands (Mustapha *et al.* (1988), (1991), Babalola (1991, 1992), Olu Owolabi *et al.* (1990), or are presented as either a supplement to expound the learning ability of the second language learner (Ogunbowale (1970), or as encyclopedic reference material (Fakinlede 2003) and so on. Thus, the compounding of the numerals, analyzed within a theoretical framework

is a feat yet to be achieved. This paper intends to achieve the feat. Moreover, other grammarians have discussed Yoruba morphology of compounding extensively. Taiwo (2004, 2005) has described the various ways Yoruba employs to form compound nouns, yet none of the examples in the series included numerals. This paper intends to extend the phenomenon of compounding with numerical instances.

2. Classification of Yoruba numerals

Yoruba numerals have been classified into cardinal (Onkaye) and ordinal (Onkapo) numerals. Mustapha *et al.* (1988) have further sub-classified the cardinal numbers, as follows: the first in form of – (eni, eji, eta, ...), the second in the form of – (meni, meji, meta, ...).

The underived relic numerals (stilted)

The use of the term ‘relic numerals’ authenticates the primitiveness of numbering tradition in that relics stand for object or tradition that has survived over a long period of time, but whose parts still remain. Akmajian (1992), while explaining derivational morphology, posits that

... when a language does not seem to have just the right expression for certain purposes. Speaker often take an existng one and extend its meaning in a recognizable way.

Thus, we have to allow a set of primitively existing base word at which numerals are derived. These are:

- | | | | | |
|----------|---------|---------|----------|----------|
| (a) okan | (b) eji | (d) eta | (e) erin | (e) arun |
| (f) efa | (g) eje | (h) ejo | (i) esan | (j) ewa. |

These items are base generated. They are underived, and they are arbitrary terms just as there are other existing items in the lexicon of Yoruba speakers are arbitrary.

Evidence for the underivational status of the relic-numerals

Unlike the derivational numerals, these relic numerals cannot be derived according to Owolabi's (1995) prefixing morphology where prefixes are attached to roots that are verbs. The corroborating evidence for this is in the fact that the semantic meaning of the verbs has no intrinsic relationship with the numeral-noun they referred to if they are so derived, contrarily the verbs semantically point to a very strange action or occurrence.

The contents of the table below confirm the unacceptable meaning that will result.

Table 1: *Yoruba Relic-Numerals*

	The relic/underived numerals	The structure of the attempted derivation according to Owolabi (1999)	The corresponding verb/adjective in the derivation	The semantic meaning of the verb or adjective
(a)	Okan	*o + kan	Kan ²	Adj; ‘Sour’ ‘peevisish’
(b)	eji	*e + ji	ji	‘Adj ‘to sink’ ³ ‘far’ distant

(c)	eta	*e + ta	ta	'to spill' 'to shoot at'
(d)	erin	*e + rin	rin	'to grate or wet'
(e)	arun	*e + run	run	'to chew' 'masticate or break into pieces'
(f)	efa	*e + fa	fa	'to pull' 'to crawl'
(g)	eje	*e + je	*je ⁴	-
(h)	ejo	*e + jo	jo	'to resemble' 'to gather together'
(i)	esan	*e + san	san	'to gird or bind' 'to crack' 'to thunder'
(j)	ewa	*e + wa	wa	'to come' 'to search'
(k)	ogun	*o + gun	gun	'to pound' 'to pierce or thrust'
(l)	ogbon	o + gbon	gbon	'to shake violently' 'to tremble'

Observe the unparallel results between the verbs/Adjectives and the numerals it represented if we are to derive these items. We have no option than to take these numerals as 'given above' and use it to derive all other numerals existing in the language. Even all the pedagogic materials consulted try to show the derivations of other, except these ones simply because it is underived.

3. The Derivational Numerals

In morphology, complex words are built from simpler words and morphemes. Akmajian (1992) using some listed English items identified four types of compounds namely: Noun-Noun, Adjective-Adjective, Adjective Noun and Noun Adjective. Taken the underived relic-numerals described above, we can sub classify the Yoruba numerals into two namely: The Noun-Adjective compounds and the Verb-Noun compounds.

The Noun-Adjective Numerals

These are derived from the underlying structure as a combination of noun and adjective. But before it is realized at the surface structure, a lot of processes of transformation have applied so that what we have in the surface form is different in outlook. There are many items that are countable in Yoruba; animals, food items, livestock etc., but Yoruba place a high premium on counting money, that is why there is a saying that "Owo ni koko" i.e. (Money is paramount). As a result, Yoruba, against all odds attaches the item 'owo' to its numbering system as if 'owo' is the only item that should be counted so that the underlying nature of what we classify as Noun-Adjective numerals will be the combination of the noun 'owo' and the underived relic-numerals previously described. It follows then with the rules described below⁵.

- (a) Combine the noun ‘owo’ and the relic-numeral (okan) which is used as adjective numeral in this context as follows:

*Underlying phrase: owo + okan “one money”
 money one

*Contraction Rule: owookan

*Deletion Rule: owookan → o’okan

- (b) Underlying Phrase: owo + eji
 Contraction Rule: owoeji

Regressive assimilation of the quality of the first vowel in the Adjective numeral to the two vowels of the first noun⁶ as thus:

Assimilation: owooji → eweeji
 Deletion Rule: eweeji → e’eeji
 Derived numeral: eeji⁷

- (c) Underlying Phrase: owo + eta
 Contraction Rule: owoeta
 Assimilation: owoeta → eweeta
 Deletion Rule: eweeta → eeta
 Derived numeral: eeta

The processes described in (b) and (c) occur exactly in the derivation of *marun-un*, *eefa*, *eeje*, *eejo*, *eesan-an* and *eewaa*. However, the derived form of *aarun-un* and *eesan-an* exhibit an extraneous high toned last syllable of the derived numerals, which is hyphenated. A technical question is why are these numerals derived with such a high tone? Or how come that derivation differs from the rest?

Owolabi (1989) describes the structure of emphatic sentence which lengthens the vowel of the final syllable if the final syllable has a high tone. In the same vein, the final syllable of the relics numerals in (a) – (i) table 1 are low or mdi except that of *arun*, *san* and *ewa*. The vowel lengthening is triggered by the occurrence of the high tone on the last syllable of the second relic-numerals so that the lengthening will accommodate all the tones present in the underlying structure. Another question is, why is *aarun-un* and *eesan-an* hyphenated while *eewaa* which is the third counterpart is non-hyphenated?

Although, Akmajan (1992) stated that

The hyphen is used when a compound has been newly created or is not widely used; when a compound has gained a certain currency or permanence, it is often spelled closed up, without the hyphen.

But in this case all the numerals have an equal permanence. We are forced to maintain that the difference in hyphenation between the derived numerals, is a result of the nasality feature present in *aarun-un* and *eesan-an* which is absent in *eewaa*.

Table 2: *The table showing the different process in Noun-Adjective numerals*

The underlying phrase	Contraction Rule	Assimilation Rule	Deletion Rule	Derive Numeral	Lengthening
owo okan	owookan	-	o'o'kan	ookan	-
owo eji	owoeji	eweeji	e'e'ji	eeji	-
owo eta	owoeta	eweeta	e'e'ta	eeta	-
owo erin	owoerin	eweerin	e'e'rin	eerin	-
owo arun	owoarun	awaarun	a'a'run-un	aarun-un	aarun-un
owo efa	owoefa	eweefa	e'e'fa	eefa	-
owo eje	owoeje	eweeje	e'e'je	eeje	-
owo ejo	owoejo	eweejo	e'e'jo	eejo	-
owo esan	owoesan	eweesan	e'e'san	ee'san	eesan-an
owo ewa	owoewa	eweewaa	e'e'waa	eewaa	eewaa

4. The Upper Category Noun-Phrase Numerals

This type is upper in category in that it is greater in grammatical rank-scale. This involves the contraction of a whole phrase. Other works have explained the science in which we add from *okan* to *erin* as it appears in [... *le* ...] form and the subtraction from *erin* to *okan* as in [... *din* ...] But our concern is in the linguistic processes in the derivation. This type of numeral is derived by the combination of the processes described in (1) with another three-segment deletion as follows:

- (a) Underlying sentence: owo kan le ewa 'one money passes ten'
money one pass ten

Given that the derivation of *ookan* has been explained.

Contraction Rule:	ookan le ewa	→	ookanlewa	‘one pass ten’
Deletion Rule:	ookanl'''a	→	ookanla	‘eleven’
Derived numeral:	ookanla			‘eleven’

- (b) Underlying sentence owo eji le ewa
Derivation: [NP eeji[VP le [NP ewa]]]
two pass ten

Contraction Rule:	eeji le ewa	→	eejileewa	'two pass ten'
Deletion Rule:	eejileewa	→	eejil'''a	'twelve'
Derived Numeral:	eejila			'twelve'

The process is the same in *eetala* and *eerinla*. However, it is intriguing to note that the low high tone in the numeral *ewa* remains impervious to the three-segment deletion that occurs. In other words, the low-high tones survive and appear on the last two syllables of the derived numeral. There is a different reaction between the derivational processes explained above with *eedogun* and its variants *aarundinlogun*. We are

suggesting that the change in polarity, caused by the subtraction from the underived relic-numeral *ogun* ‘twenty’ that triggers this reaction. The direction of polarity is represented below:



While the derivational processes explained before and after now holds for *aarundinlogun* except that the nasal lengthening is deleted simply because the tone on the nasal vowel coincide with that on ‘*din*’ thereby deleting one for the other. We are not resolving the issue about *eedogun*, in that one cannot locate even a single vowel quality in the underlying structure that corresponds to the half open front [ɛ] in the surface structure. Further enquiry would still have to reveal how come this reaction.

Others are derived for 16-19 in the same manner as shown below:

Underlying sentences: *owo erin din ni ogun*

The partially derived form: [_N *eerin* [_{VP} *din ni* [_{NP} *ogun*]]]
 Four less loc twenty

Contraction: *eerindinniogun*
 Deletion Rule: *eerindinn’ogun*
 Denasalization Rule⁸: *eerindinl’ogun*
 Derived form: *eerindinlogun*

4.3 The Verb-Noun Derivational Numerical

It has been said earlier that what Mustapha *et al.* (1991) consider as synonyms of the cardinal numerals are different derivatives in our own view is the verb-noun type. It is a verb phrase where the verb ‘*mu*’ ‘take’ is the head and it subcategorizes for the underived relic numerals as the NP complements, as represented in the frame: *mu*, [-NP]. The numerals are derived thus:

Underlying VP <i>mu eni</i>	<i>[_{VP} [_V <i>mu</i> [_{NP} <i>eni</i>]]]</i>
(a) Contraction Rule:	<i>mueni</i>
Deletion Rule:	<i>m’eni</i>
Tone Displacement:	<i>m’eni</i>
Derived:	<i>meni</i>

(b) Underlying verb phrase <i>mu eji</i>	<i>[_{VP} [_V <i>mu</i> [_{NP} <i>eji</i>]]]</i>
Contraction Rule:	<i>mueji</i>
Deletion Rule:	<i>m’ej</i>
Tone displacement:	<i>m’ej</i>
Derived numeral:	<i>meji</i>

4.4 The Stacked (VP) Derivational Numerals

The category of the underlying structure of the VPs in derivation of this type is upper in the sense that two verb phrases are stacked together to derive this numerals as follows:

Underlying stacked VPs

(a)[_{VP} [_V mu [_{NP} okan [_{VP} [_V le [ewa]]]]]]
 Take one pass ten

Contraction Rule: mu okanleewa

Deletion Rule: m'okanla

Tone displacement: mokanla

Derived: mokanla

The derivation holds this way for *mejila*, *metala*, *merinla*. Also the derivation of subtraction pole takes place accordingly this way:

Underlying stacked VP Mu erin din ni ogun
 take four less loc twenty

Contraction Rule: m'erindinn'ogun

Tone Displacement: merindinnogun

Denazalization Rule: merindinlogun

We have the same explanation given earlier in *eedogun* for *meedogun*, but it is our aim that other subsequent findings will still provide any further available glimpse. However, we have just considered what might be regarded as an introduction to numerical compounding in Yoruba. The type referred to as ordinal has not yet been scratched at all, yet all of these numerals progressed into an inexhaustive number displaing such highly productive linguistic processess. It is our aim to carry on further research on numerical compounding in other subsequent available academic forum.

Conclusion

So far, we have been able to propose a given underived relic-numeral in Yoruba, which serves as the root morpheme, which all other numerals are derived from. What is regarded as different synonyms to the cardinal numerals by Mustapha *et al.* have been shown to display highly different phonological and morphological processes. The system of compounding are in the order of Noun-Adjective at a lower and upper category and Verb-Noun compounds at both lower and upper category. The occurence of each of the groups of the numerical compounds interfaces both phonological and morphological processes. These reactions are a true confirmation of one of Noam Chomsky's features of human language that human language is PRODUCTIVE.

Notes

1. Note the asterisk, which indicate the unacceptability of the meaning of the corresponding verb with the numerals it stands for.
2. It is used as an adjective numeral modifying a noun e.g. *eyin kan* ‘one egg’ as will be explained subsequently.
3. This verb occurs only in Awori dialect as a denasalized form of the standard form *jin* ‘to sink’ or otherwise as the adjective ‘far’. See Aina (2004).
4. A nonsensical word that does not exist as an independent lexical item in standard Yoruba.
5. Note that there is a regular tone change on the first vowel of the relic-noun from low to high before it is used to derive the Noun-Adjective numerals except on *arun*, *esan* and *ewa* that is (*ejì* to *èjì*, *etá* to *ètá* and so on).
6. There is an alternative explanantion to this. It can be derived by either firstly applying deletion rule which deletes the whole second syllable of the first noun *owo* before assimilation as thus: Deletion Rule: *owoèjì* *oèjì* then regressive assimilation of the first vowel in the adjective numeral. Assimilation: *Oèjì* *eejì*. This suggest a kind of economy of effort in producing the derived numeral, otherwise the surviving tones and segments in *owo* will yield *oo*, compared to the first derivation in (a) above will be *ooèjì*, and this will be assimilated as *eejì*. Or we apply assimilation firstly and delete the first vowel of the Adjective numerals as done for *ookan* thus: *Owoèjì* *eejì* *eejì*.
7. See Owolabi (1989:225ff) for the description of some upper category numerals.
8. there is a phonological rule in Yoruba that converts a nasal consonant to a lateral if it is followed by any nasal vowel other than [i]. See Owolabi (1989:211) and Oyebade (1998:15) for more details.

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The Numeral System of Obolo

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This paper is a description of the numeral system of Obolo. As in many African languages, the Obolo language records two counting systems (the traditional and the modern). The traditional (vigesimal) system of counting employs such mathematical processes of addition, subtraction, multiplication and a combination of two or more of these processes to derive certain numbers. The paper also observes that the process of subtraction which is uniquely embedded in the counting system of Obolo is a very rare phenomenon in African languages. The complex mathematical processes, notwithstanding, the language records the highest numeral as 400, which means that counting in the language is limited and anything above 400 attracted even more complicated mathematical processes. The paper further notes that a simplified modern (decimal) system, yet to gain ground, has evolved to reduce the difficulty encountered in the traditional system to the barest minimum and to enable speakers to count to infinity. We, therefore, recommend that a serious awareness campaign programme be put in place to enable speakers to learn the new simpler system and count in the language to avoid language extinction in this area.

1. Introduction

The Obolo language is spoken by the Obolo (Andoni) people residing in parts of Rivers and Akwa Ibom States of Nigeria. The Andoni people are among the coastal communities of the Niger Delta of Nigeria and their language comprises five divergent dialects namely, Ataba, Unyeada, Ngo (all in Rivers State), and Okoroete and Ibot-Obolo (in Akwa Ibom State). According to Enene (1997:3), while Ataba and Unyeada varieties are spoken in the western part of Obolo, and the Ngo variety is spoken in the central part of Obolo, the Okoroete and the Ibot-Obolo varieties are spoken in the eastern part of Obolo. Williamson (1989:26) classifies Obolo as a member of the Lower Cross of the Delta Cross branch of the eastern division of the South Central Niger-Congo languages.

According to Dienye (1987:6), Obolo records twenty-six phonemic consonants such as:

/p b t d k g kp gb k^w g^w m ŋ n ɲ ŋ^w tʃ dʒ f s ʃ h r l j w/.

They are represented orthographically as:

‘p b t d k g kp gb kw gw m mm n ny ñ nw ch j f s sh h r l y w’

respectively. Conversely, there are twelve phonemic oral vowels comprising six short vowels:

/i e a u o ɔ/

orthographically represented as:

‘i e a u o ɔ’

respectively, and six long vowels such as:

/i: e: a: u: o: ɔ:/.

The long vowels are represented orthographically as two identical sounds as:

‘ii ee aa uu oo ɔɔ’, respectively.

Like many African languages, the Obolo language is a tone language. According to Welmers (1973:80), Welmers (1959) says that a tone language is ‘a language in which both pitch phonemes and segmental phonemes enter into the composition of at least some morphemes’. Tone is significant in a tone language. This means that the substitution of one tone on a syllable with another tone can bring about differences in the meaning of words or sentences (Alerechi 2007:99; 2010). Dienye (1987:82) identifies such tone as low (`) and high (´) tones; a mid (-), and two contour tones - falling (ˆ) and rising (ˇ) tones. In course of analyzing the counting system of the Obolo language, the present paper uses both the segmental and the suprasegmental features as represented in the Obolo orthography.

The majority of African languages such as Igbo, Kana, Echie, Òko, Ikwere, and the Ife variety of Yoruba as reported by Emenanjo (1978:54), Ikoru (1996:85), Ndimele (2003:119), Atoyebi (2006:64), Alerechi and Weje (also in this volume) and Fàbùnmi (2010:37), respectively, record traditional system of counting, which is the vigesimal counting (counting done in the base of twenty (Armstrong 1962)). The vigesimal counting system is said to be very complex, ambiguous and inadequate to cope with the requirements of modern technology and science due to the different mathematical processes it employs. This has, therefore, made speakers of these languages to shy away from counting in the indigenous languages. It is worthy of note that the complexity of the vigesimal system has contributed to the near extinction of the languages in this area. To this end, linguists and/or language committees of some languages have proposed and adopted a simpler (decimal) counting system (10-based numeration system (Menninger 1969)) to make counting in the indigenous languages less cumbersome and to be able to cope with the requirements of modern technology and thus, encourage speakers to count in their languages. Examples of languages that have decimalized their counting system are Igbo, Ikwere and Efik as recorded by Emenanjo (1978), Alerechi and Weje (also in this volume) and Mensah (on line), respectively. This move toward a decimal counting system in these languages is in conformity with the observation of Comrie (2005) that the great majority of the languages of the world use decimal counting system. It is interesting to note that Obolo is one of the languages that have shifted from the traditional (vigesimal) counting system to the modern (decimal) counting. The present paper, therefore, gives a description of both the traditional and the modern system of the language with a view to identifying the complexities inherent in the vigesimal system; identify areas where the decimal system could curb or minimize such complexity, and thus encourage speakers to count in the language.

2. The Traditional Counting in Obolo

The traditional counting system of Obolo is vigesimal, which means that counting is done in the base of 20 (twenty). It records significant landmarks such as **gê** ‘one’, **àkòp** ‘ten’, **éfi** ‘twenty’, **óbóp** ‘four hundred’, which are simple in form and not derivable from any other number. Apart from these landmarks that are simple in form, we observe that the cardinal numbers from ‘two’ (2) to ‘nine’ (9) are also simple in form and are not derived from any other number. On the other hand, the cardinal numbers from eleven and above are derived through different mathematical processes. Thus, Obolo records simple and derived cardinal numbers in the traditional counting system. The derivations involve two stages. The first stage reflects the numbers from ‘eleven’ (11) to ‘fourteen’ (14), which are compound in form and the number ‘ten’ (10) serves as the base to which the smaller units ‘one’ (1) to ‘four’ (4) are added. The second stage reflects the numbers ranging from ‘twenty-one’ (21) and beyond, excluding the various landmarks. In this stage, 20 serves as the base to which lesser units are either added, subtracted or multiplied to derive other numbers. This method of counting in the base of 20 continues till 400 as this is the highest numeral value in the traditional numeral system of Obolo and anything beyond this involves complex mathematical processes. Intermediate to the two stages reflects a unique form involving the numbers from 15-19. It is interesting to note that Obolo does not record any overt base for these numbers even though they are implicitly derived from base 20 as it is only from 20, that 5 can be subtracted to yield 15, for instance. We therefore present the numerals in Obolo based on the simple and the derived forms.

2.1 Simple Words

The numerals expressed through simple words have syllable structures ranging from those comprising monosyllabic, disyllabic and polysyllabic words. The monosyllabic numerals include **gê** ‘one’ and **gò** ‘five’. While the majority of the simple words numerals are disyllabic as in **íbà** ‘two’, **ítá** ‘three’, and so on, a few others are polysyllabic as in **gwèrègwèn** ‘six’. Table 2.1 represents examples of simple words numerals in Obolo.

Table 2.1: *Counting by simple words*

1	gê	one
2	íbà	two
3	ítá	three
4	ínî	four
5	gò	five
6	gwèrègwèn	six
7	jààbà	seven
8	jèètá	eight
9	ònààngè	nine
10	àkòp	ten
20	éfi	twenty
400	óbóp	four hundred

The foregoing examples of simple words numerals in Obolo predominantly involve the various landmarks. One thing that is common to the above numerals is the absence of mathematical process.

2.2 *Derivation of Numerals in Obolo*

This section treats the different ways numerals are derived in Obolo. The derivations involve the use of combined words through some mathematical processes. The processes include addition, subtraction, multiplication and combination of different mathematical processes to yield certain numerals.

2.2.1 *Counting by Addition*

The first mathematical process involved in the derivation of some numerals in Obolo is addition. The number units ‘one’ to ‘four’ are added to either base ten (10) or twenty (20) to derive compound numbers. The process of addition is expressed with the additive morpheme **me** ‘and’ to connect the appropriate unit to a particular base to derive the intended number. In Obolo counting by addition begins with the cardinal number ‘eleven’ (11). The morpheme **me** generally takes high tone but marked low when it is contiguous to a falling tone syllable. Consider the following examples in table 2.2.

Table 2.2: *Counting by Addition*

11	àkòp mègê	10+1	eleven
12	àkòp mé íbà	10+2	twelve
13	àkòp mé ítá	10+3	thirteen
14	àkòp mé ínî	10+4	fourteen
21	éííp mé gê	20+1	twenty-one
30	éííp mè àkòp	20+10	thirty

2.2.2 *Counting by Subtraction*

Subtraction is the second mathematical process employed in the traditional counting system of Obolo to derive certain numbers. It is embedded into the counting system of the language and the unit numbers are removed from the base numbers in a descending order. This is a very unique phenomenon in Obolo particularly when one remembers that the process of subtraction is employed in other languages in the counting of money and/or mostly used by the older generation of speakers to display their competence in that language. It is also interesting to note that Obolo does not record any overt base from which units ‘five’ (5) to ‘one’ (1) may be subtracted to derive numbers ‘fifteen’ (15) to ‘nineteen’ (19). However, it logically implies that the numeral units ‘five’ (5) to ‘one’ (1) can only be removed from base ‘twenty’ (20) to derive the appropriate numbers. The process of subtraction is marked with the word **ínáán** meaning ‘less’. Table 2.3 gives a clear understanding of how this process really works.

Table 2.3: *Counting by Subtraction*

15	ĩnáán gò	-5	fifteen
16	ĩnáán ínî	-4	sixteen
17	ĩnáán íta	-3	seventeen
18	ĩnáán íbà	-2	eighteen
19	ĩnáán gê	-1	nineteen

Table 2.3 shows that counting by subtraction alone, involves mainly the numerals from ‘fifteen’ (15) to ‘nineteen’ (19).

2.2.3 Counting by Multiplication

The multiplication process is yet another mathematical process used by the Obolo speakers to derive certain other numbers. It does not have an overt connecting morpheme as we observed in the preceding sub-sections. Table 2.4a demonstrates some examples of counting by purely multiplication in the language.

Table 2.4a: Counting by Multiplication

40	éfi̯p íbà	20x2	forty
60	éfi̯p íta	20x3	sixty
80	éfi̯p ínî	20x4	eighty
100	éfi̯p gò	20x5	hundred
200	éfi̯p àkòp	20x10	two hundred

There is a preponderant use of different phonological processes in the actual realization of most of the derived numerals in fast or normal speech. For instance, the native speakers of Obolo will pronounce the numerals in table 2.4a differently as in table 2.4b.

Table 2.4b

40	éfi̯wí̯bà	forty
60	éfi̯wí̯ta	sixty
80	éfi̯wí̯nî	eighty

Table 2.4b demonstrates that the final voiceless bilabial plosive [p] in éfi̯p ‘twenty’ is articulated as the labial velar central approximant [w], in anticipation of another word, thus reflecting the phonological process of vocalization (weakening to glide). The language records similar phonological processes of this nature in the numeral system. This therefore requires further study.

Apart from the purely mathematical processes of addition, subtraction and multiplication treated so far, Obolo further records more complex processes, which reflect a combination of more than one mathematical process. We treat them in the following subsections.

2.2.4 Counting by Subtraction and Addition

Here counting is done by combining the mathematical processes of subtraction and addition at the same time to derive a particular numeral. This method of counting begins from the number ‘twenty five’ (25) and ends in ‘twenty nine’ (29). The connective morpheme **me** is used twice with tonal modification to express both the subtraction and addition processes. It is marked with a high tone when it is used with the subtraction marker as in **ĩnáán ... mé** to mean ‘subtract from’, while **me** takes low tone to express addition. Thus, a particular numeral unit is removed from base 20 and the numeral 10 is then added to derive the appropriate number. Consider examples in table 2.5.

Table 2.5: *Counting by Subtraction and Addition*

25	ĩnáán gò mé étíp mè àkòp	-5 from 20+10	twenty-five
26	ĩnáán ínî mé étíp mè àkòp	-4 from 20+10	twenty-six
27	ĩnáán íta mé étíp mè àkòp	-3 from 20+10	twenty-seven
28	ĩnáán íbà mé étíp mè àkòp	-2 from 20+10	twenty-eight
29	ĩnáán gē mé étíp mè àkòp	-1 from 20+10	twenty-nine

2.2.5 Counting by Subtraction and Multiplication

Counting here is done by combining the mathematical processes of subtraction as in table 2.5 and multiplication without an overt connective marker to derive the appropriate number. It is interesting to note that this derivation is mainly restricted to numerals with base ‘twenty’ or multiples of base ‘twenty’ and ‘ten’ with units 5 to 9. Thus, the numerals involving subtraction and multiplication processes range from ‘thirty-five’ (35) to ‘ninety-nine’ (99) excluding ‘forty-five’ (45) to ‘forty-nine’ (49), ‘sixty-five’ (65) to ‘sixty-nine’ (69) and ‘eighty-five’ (85) to ‘eighty-nine’ (89). Consider the examples in table 2.6.

Table 2.6: Counting by Subtraction and Multiplication

35	ĩnáán gò mé étíp íbà	-5 from 20x2	thirty-five
38	ĩnáán íbà mé étíp íbà	-2 from 20x2	thirty-eight

56	ĩnáán ínî mé étíp íta	-4 from 20x3	fifty-six
59	ĩnáán gê mé étíp íta	-1 from 20x3	fifty-nine
75	ĩnáán gò mé éfiṗ ínî	-5 from 20x4	seventy-five
76	ĩnáán ínî mé éfiṗ ínî	-4 from 20x4	seventy-six
97	ĩnáán íta mé éfiṗ gò	-3 from 20x5	ninety-seven
99	ĩnáán gê mé éfiṗ gò	-1 from 20x5	ninety-nine

2.2.6 Counting by Multiplication and Addition

The numerals in this section involve the combination of the processes of multiplication and addition. It reflects numbers derived by multiples of base ‘twenty’ and the numbers ‘one’ (1) to ‘four’ (4) or ‘ten’ (10). Both mathematical processes retain their various markers as they are expressed in similar ways as in the previous sections. Consider the examples in table 2.7.

Table 2.7: *Counting by Multiplication and Addition*

41	éfiṗ íbà mè gê	20x2+1	forty-one
42	éfiṗ íbà mé íbà	20x2+2	forty-two
50	éfiṗ íbà mé àkòp	20x2+10	fifty
63	éfiṗ íta mé íta	20x3+3	sixty-three
64	éfiṗ íta mé ínî	20x3+4	sixty-four
70	éfiṗ íta mé àkòp	20x3+10	seventy
81	éfiṗ ínî mé gê	20x4+1	eighty-one
90	éfiṗ ínî mé àkòp	20x4+10	ninety
101	éfiṗ gò mé gê	20x5+1	hundred

2.2.7 Counting by Subtraction, Multiplication and Addition

This section records one of the most complex derivative processes in Obolo. This is because it involves a combination of three different mathematical processes such as subtraction, multiplication and addition to derive certain numerals in the language. Consider examples in table 2.8.

Table 2.8: *Counting by Subtraction, Multiplication and Addition*

45	ĩ náán gò mé étíp íbà mè àkòp	-5 from $20 \times 2 + 10$	forty five
49	ĩ náán gē mé étíp íbà mè àkòp	-1 from $20 \times 2 + 10$	forty nine
66	ĩ náán ínî mé étíp ítá mè àkòp	-4 from $20 \times 3 + 10$	sixty six
88	ĩ náán íbà mé éfíp ínî mè àkòp	-2 from $20 \times 4 + 10$	eighty eight
119	ĩ náán gē mé étíp gò mè éfíp	-1 from $20 \times 5 + 10$	hundred and nineteen

The foregoing analysis of the mathematical processes involved in the derivation of numerals in Obolo, demonstrates how clumsy and complicated the traditional system is. Considering the complexity inherent in the preceding analysis, it is not surprising that speakers would find it convenient to resort to a simpler form that would enable them to communicate intelligibly with their listeners. Thus, most Obolo speakers prefer to count in English rather than their indigenous language even when interacting with other native speakers. No wonder the Obolo people are among the language groups to initiate a simpler counting system as portrayed in the modern counting in section 3.

3. The Modern Counting System: The modern counting system evolved with the publication of *Aya Ifuk Obolo* by the Obolo Language & Bible Translation Project in 1985. It is a shift from the vigesimal 20-based counting to the decimal 10 –based counting system. The new system is much simpler than the old counting system, which is very limited and complex. Table 3.1 gives the landmarks of the modern counting system in Obolo.

Table 3.1: *Obolo modern counting landmarks*

0	òfók	zero
1	gē	one
10	àkòp	ten
100	éfit	hundred
1000	óbóp	thousand
1,000,000	éfiè	million
1,000,000,000	ègô	billion
1,000,000,000,000	ñgwúgwù	trillion

The above landmarks demonstrate that the modern counting system of obolo is decimalized (in the base of 10). It ranges from òfók ‘zero’ to ñgwúgwù ‘trillion’, while those of the traditional system ranges from gē ‘one’ to òbóp ‘four hundred’. Whereas the traditional system records four landmarks, the modern one has eight. This implies a simplification of the complicated mathematical processes used to derive

certain numerals in the old system. For economy of presentation, we list examples of mostly numbers that are different from the traditional counting system in table 3.2.

Table 3.2: The Modern Counting System

0	òfók		zero
1	gê		one
14	àkòp mé ìní	$10+4$	fourteen
15	àkòp mé gò	$10+5$	fifteen
19	àkòp mé ọ̀nààngè	$10+9$	nineteen
20	àkòp íbà	10×2	twenty
21	àkòp íbà mé gê	$10 \times 2 + 1$	twenty one
25	àkòp íbà mé gò	$10 \times 2 + 5$	twenty five
30	àkòp ítá	10×3	thirty
32	àkòp ítá mé íbà	$10 \times 3 + 2$	thirty two
37	àkòp ítá mé jààbà	$10 \times 3 + 7$	thirty seven
40	àkòp ínì	10×4	forty
44	àkòp ínì mé ìní	$10 \times 4 + 4$	forty four
48	àkòp ínì mé jéétá	$10 \times 4 + 8$	forty eight
50	àkòp gò	10×5	fifty
58	àkòp gò mé jéétá	$10 \times 5 + 8$	fifty eight
60	àkòp gwèrègwèn	10×6	sixty
61	àkòp gwèrègwèn mé gê	$10 \times 6 + 1$	sixty one
70	àkòp jààbà	10×7	seventy
72	àkòp jààbà mé íbà	$10 \times 7 + 2$	seventy two
80	àkòp jèètá	10×8	eighty
83	àkòp jèètá mé ítá	$10 \times 8 + 3$	eighty three
85	àkòp jèètá mé gò	$10 \times 8 + 5$	eighty five
90	àkòp ọ̀nààngè	10×9	ninety
98	àkòp ọ̀nààngè mé jèètá	$10 \times 9 + 8$	ninety eight
99	àkòp ọ̀nààngè mé ọ̀nààngè	$10 \times 9 + 9$	ninety nine
100	éfit		hundred
101	éfit gê mé gê	$100+1$	hundred and one
120	éfit gê mé àkòp íbà	$100+10 \times 2$	hundred and twenty
200	éfit íbà	100×2	two hundred
400	éfit ínì	100×4	four hundred
500	éfit gò	100×5	five hundred
1000	óbóp		thousand
2000	óbóp íbà	1000×2	two thousand
10,000	àkòp óbóp	1000×10	ten thousand
100,000	éfit óbóp	1000×100	hundred thousand
500,000	éfit óbóp gò	5000×100	five hundred thousand
1,000,000	éfiè		million
1,000,000,000	ègò		billion
1,000,000,000,000	ñgwúgwù		trillion

Table 3.2 demonstrates that the complexity recorded in the traditional counting system of Obolo has been reduced to its barest minimum in the modern counting. This will help to facilitate the learning of the numerals, encourage counting in the language, make for easy translation of the Obolo numerals to English and vice versa, and consequently, avoid extinction.

A cursory look at both the traditional and modern counting systems of Obolo reveals a number of similarities and differences. We highlight them in section 4.

4. The Traditional and Modern Counting Systems Obolo Compared

The traditional and modern counting systems are similar and different in a number of ways. On the grounds of similarities, the two counting systems record the same forms from numbers ‘one’ to ‘fourteen’. Both systems also use the mathematical processes of addition and multiplication. The two processes may or may not be combined to derive higher numbers in both systems. The additive morpheme **mé** is used in the same way in both systems.

On the grounds of differences, the traditional system operates a vigesimal numeral system, while the modern system operates a decimal numeral system. The subtraction process present in the traditional system is completely eliminated in the modern system, leaving the addition and multiplication processes intact. Another very interesting difference is that in the traditional system, ‘four hundred’ is the highest numeral value that can be counted while in the modern system, one can count from one to infinity. It is worthy of note that the number **óbóp** used to express ‘four hundred’ (400) in the traditional system is now used to refer to ‘thousand’ (1000) in the modern system. It is easier to translate Obolo numerals to English and vice versa in the modern system than in the traditional system. While the traditional counting is extremely complex, that of the modern system is a simplified version in the language.

From the analysis of the numeral system of Obolo, we observe that there is a major change or shift from the traditional to the modern system. This is because virtually all the numbers from ‘fifteen and beyond are innovations. One wonders how speakers who already have knowledge of the old system can effectively adapt to the new one without undergoing rigorous training. This therefore, requires a serious and urgent awareness programme to bring the existence of a simpler counting system to the knowledge of the speakers and to get them to count in the language. It is, however, claimed (personal communication) that many Obolo indigene have adapted to the use of the modern system (a welcome development).

5. Conclusion

In this paper, we observed that the traditional counting system of Obolo is vigesimal (20-based). It is very complex as it employs different mathematical processes to derive certain numbers. Obolo numeral system is uniquely different from most numeral systems in African languages because of the embedded process of subtraction in the system. The difficulty the entire system poses has led to the evolving of a modern (simpler) system, which is decimal (10-based). We believe that serious awareness campaign programme of the existence of a simpler system of counting in

the language and the subsequent use of the same will help to curb language endangerment in this area.

Note

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The Imperatives of Documenting Counting Systems in African Languages: A Window into the Cognitive Process of Computation*

Francis Oyebade

Introduction

Language Documentation is a relatively new area of research endeavour in Linguistics. Indeed, as Woodbury (2003:35) notes, “In the last fifteen years, we have seen the emergence of a branch of linguistics which has come to be called Documentary Linguistics. It is concerned with the making and keeping of records of the world’s languages and their patterns of use.” Himmelmann (1998:166) attempts to clarify the difference between language documentation and language description. In his view, “The aim of language documentation is to provide a comprehensive record of the linguistic practices characteristic of a given speech community”.

Linguistic practices and traditions are manifest in two ways:

- a. the observable linguistic behaviour, manifest in everyday interaction between members of the speech community, and
- b. the native speakers’ metalinguistic knowledge, manifest in their ability to provide interpretations and systematizations for linguistic units and events.

Himmelmann notes that,

This definition of the aim of a language documentation differs fundamentally from the aim of language descriptions: a language description aims at the record of A LANGUAGE, with ‘language’ being understood as a system of abstract elements, constructions, and rules that constitute the invariant underlying structure of the utterances observable in a speech community.

Language Documentation has proceeded in close alliance with the endangered language programme being carried out in many linguistics departments across the globe.

The main concern of this paper is the fact that counting system as a feature of African Languages and African Linguistic behaviour is endangered precisely because “... Language practices in communities around the world are shifting so quickly away from traditional heritage languages and towards the 50 or so most important regional, national, and world languages, ...” (Woodbury 2003:37) such that the diversity that is easily observed in various African counting systems is gradually being eroded by the more dominant decimal system of what are known as ‘world languages’. I find myself in total agreement, in this regard, with Everett (2003:149-150) when he says “As a linguist I am concerned with the theoretically significant lessons [African Language Counting System] have to teach us and the many lessons we will fail to learn if any of these [systems] are lost without careful documentation.”

One of the off-quoted response of modern Africa Language speakers to the traditional counting system in their language is that the numerals are derived in a “cumbersome and complicated manner” (Awobuluyi 1994:33). For many African Languages, this has given rise to various attempts at revising the system in order to simplify it for modern learners. While this attempt at revision may be understandable, it is nonetheless true that the mathematical ingenuity that formed the basis of this ‘cumbersome’ system is slowly being eroded and therefore lost to subsequent generations of speakers of the language.

2. Critical Factors in Documenting Counting Systems

Numbers and their uses are a very crucial part of the life of man and this point is even more emphasized in this computer age. It has been argued that much of the wisdom that underlie the computer technology was derived from the ancient counting system of the Greeks (box or sand tray used to hold pebbles for counting in 1500 BC), the Orientals (beads strung for counting- which was the origin of the Abacus circa 1500 BC) and relatively more recently Napier’s rods or Napier’s bones used for mechanically multiplying, dividing and taking square roots – used in England around 1617.

In Africa, much transaction and comparison is carried on using numbers and how these impact on daily living should be grist for the mill of Documentary Linguistics. Some of the imperatives of documenting counting systems in African Languages must include multimedia presentation of gestures and body language while using numbers (for instance, do they count on fingers and toes? An Igbo informant volunteered the information that when counting, when the Igbo have exhausted the fingers, they continue by using the big toe of the right leg to draw lines in the sand), the significance of numbers in age-grade systems, counting markets days or measuring materials.

Elements of daily living that call for the use of numerals include measurement of area (of farmland, homestead, etc), measurements of length (of clothing material, wood, etc), measurement of height, measurement of volume of fluid (such as palm oil, palm wine, water, etc) and measurement of distance.

A particularly interesting aspect of numbers, counting and how these relate to daily living can be gleaned from the art of negotiating price items in the market place. The variety inherent in this activity can be realized when the bargaining system of the Yoruba is compared with that of the Hausa. In Yorubaland, the seller proposes the highest amount that he is willing to sell an item and the potential buyer suggests a lesser price; if this is agreeable to the seller, the buyer lowers the price even more and continues to lower the price until the point where the seller insists that he will not sell at a price lower than that. If this is a mutually satisfactory point, transaction is concluded. The Hausa model, on the other hand, begins with the seller proposing his highest selling point; the buyer suggests the lowest point that he can accommodate and if this is not satisfactory to the seller the buyer increases his bid. He continues to increase the bid until both buyer and seller reach a mutually satisfactory point. It should be interesting to know if bid levels are calibrated systematically or arbitrarily.

Market days determine the calculation of a week in ancient Africa. In Igboland, a week was four days as market days occur in 4-day cycles. In Akokoland, the week is a five-day cycle based on market days.

The most critical element of counting systems in African Languages as far as the linguistic system is concerned is how the language classifies things and positions numerically (cardinal and ordinal). This is the matter that will be the concern of this paper in the subsequent sections.

3. Patterns of Counting Systems: Samples from Nigerian Languages

Many researchers have noted that the numeral system in most African languages is based on either five, decimal (base ten) or vigesimal (base twenty), Oduyoye (1969) illuminates the reason for this when she says, “in counting on fingers and toes, the first point of rest is at the number 5, the number of fingers on one hand.... 10 (ten) is another point of rest [i.e. the number of fingers on the two upper limbs].... 20 (twenty) is complete in the system of counting on the fingers and toes....”² (Oduyoye 1969:3). Most languages adopt an even more complex system that manipulates and operates more than one base system. This section of the paper shall attempt to illustrate some of these basic patterns.

3.1 Base Five: Nupe³ and Ebira⁴

Right from the unit numerals, Nupe and Ebira adopt a base-five counting system, as the samples below show:

1. NUPE UNIT NUMERALS

Ìnní	‘one’
gúbà	‘two’
gúta	‘three’
gúni	‘four’
gútsun	‘five’
(gú) twàyin	‘six’
(gú) twàbà	‘seven’
(gú) twòta	‘eight’
(gú) twààni	‘nine’
gúwo	‘ten’

2. EBIRA UNIT NUMERALS

Ònyá	‘one’
Èvá	‘two’
ètá	‘three’
ènà	‘four’
èhí	‘five’
ìhínònyì	‘six’
ìhimbà	‘seven’
ìhíntà	‘eight’
ìhínnà	‘nine’
èwú	‘ten’

A careful analysis of the linguistic form of these numerals will show that unit numerals 1 to 5 are basic while 6 to 9 are composite, made up of the root form for the number '5' added to the number that is needed to complete the target numeral. Thus, in Nupe, the number '7' is made up of the numeral prefix (gú-), the derivational allomorph of '5' (-twa-) and the root of the number '2' (-ba). Likewise in Ebira, the number '7' is composed of the prefix for the next base-five group (where the prefix for the first group is ('e-), that is i-, then the root form for the number five (-hi), a nasal prefix (-m-) and finally a phonologically modified form of the root of the number '2' (-va where the labial fricative is converted to its plosive counterpart under the influence of the nasal prefix).

Documentary Linguistics will be interested to know if speakers of Ebira and Nupe count on one hand and what gestures they use from one group of five to another (raising the fingers consecutively for one group and bending them for the other?).

The next section looks at a different base system of numerals.

3.2 Base 10 (Decimal) Igbo⁵ and Esan⁶

Igbo and Esan exemplify languages that adopt a decimal system as the samples below show:

3. IGBO NUMERALS

ótù	'one'
àbuó	'two'
átó	'three'
ànó	'four'
ìsé	'five'
ìsíl	'six'
àsáà	'seven'
àsáto	'eight'
ítólu	'nine'
ìrí	'ten'
ìrí nà ótù	'eleven'
ìrí nà àbuó	'twelve'
ìrí àbuó ⁷	'twenty'

4. ESAN NUMERALS

òkpá	'one'
èvá	'two'
éa	'three'
ènèn	'four'
éhàn	'six'
ìhínlòn	'seven'
èlélén	'eight'
ìhínlìn	'nine'
ìgbé	'ten'

ugbolo	‘eleven’
igbeva	‘twelve’
igbelea	‘thirteen’
igbenen	‘fourteen’
igbehenlen	‘fifteen’
ehan yan igbe	‘sixteen’
ihinlon yan igbe	‘seventeen’
elenlon yan igbe	‘eighteen’
isinlin yan igbe	‘nineteen’
ugie	‘twenty’

Igbo computes numbers by exploiting the decimal system in a straight forward way. However the computational operations of addition and multiplication are distinguished by the morpheme ‘na’ (for addition) and a zero morpheme (for multiplication). For this, compare *iri na abuo* ‘twelve’ (literally ten-add-two) with *iri abuo* ‘twenty’ (literally, ten-twice).

Esan has a slightly different composition even though it also adopts a basic decimal system. The numerals eleven to fourteen are clear combinations of ten and the appropriate unit number. ‘Fifteen’ seems to be a composition of ‘ten’ and an allomorph of ‘five’ appearing only in composition. More interestingly, from the number ‘sixteen’ although the numerals are a composition of ‘ten’ and the appropriate numeral, the linguistic form is different from that of ‘eleven’ to ‘fifteen’. Perhaps this is evidence of an inherent base-five system in a basically decimal counting system.

3.3 Base 20 (Vigesimal): Yoruba⁸ and Ekirom⁹

Vigesimal systems, by their nature, often combine with other base systems to provide a comprehensive counting system. This combination is carried out in various ways as will become obvious from a comparison of the Yoruba and Ekirom patterns. This paper shall extensively explore both patterns as they clearly show the variety of the African language computing system that is gradually losing out to the decimal of what are termed ‘world languages’. This sub-section will rely massively on Oyebade and Agoyi (2009).

3.3.1. Yoruba Cardinal Numeral System

The following table presents the crucial elements of the Yoruba numeral system:

LINGUISTICS FORM		COMPUTATION
òkan/ení	1	1
èjì	2	2
èta	3	3
èrín	4	4
àrún	5	5
èfa	6	6
èje	7	7

èjo	8	8
èsán	9	9
èwá	10	10
mókànlá (mú-òkan-lé-èwá)	11	1 + 10
méjilá (mú-èjì-lé-èwá)	12	2 + 10
métàlá (mú-èta-lé-èwá)	13	3 + 10
mérinlá (mú-èrin-lé-èwá)	14	4 + 10
mèèédógún (mú-èrún-dín-ní-ogún)	15	5 - 20
mérindínlogún (mú-èrin-dín-ní-ogún)	16	4 - 20
métàdínlogún (mú-èta -dín-ní-ogún)	17	3 - 20
méjídínlogún (mú-èjì-dín-ní-ogún)	18	2 - 20
mókàndínlogún (mú-òkan-dín-ní-ogún)	19	1 - 20
ogún	20	20
mókànlélogún (mú-òkan-lè-ní-ogún)	21	1 + 20
méjilélogún (mú-mèjì-lè-ní-ogún)	22	2 + 20
métàlélogún (mú-èta-lè-ní-ogún)	23	3 + 20
mérinlélogún (mú-èrin-lè-ní-ogún)	24	4 + 20
mèèédógbòn (mú-èrún-dín-ní-ogbòn)	25	5 - 30
mérindínlogbòn (mú-èrin-dín-ní-ogbòn)	26	4 - 30
métàdínlogbòn (mú-èta-dín-ní-ogbòn)	27	3 - 30
méjídínlogbòn (mú-èjì-dín-ní-ogbòn)	28	2 - 30
mókàndínlogbòn (mú-òkan-dín-ní-ogbòn)	29	1 - 30
ogbòn	30	30
mókànlélogbòn (mú-òkan-lè-ní-ogbòn)	31	1 + 30
méjilélogbòn (mú-èjì-lè-ní-ogbòn)	32	2 + 30
métàlélogbòn (mú-èta-lè-ní-ogbòn)	33	3 + 30
mérinlélogbòn (mú-èrin-lè-ní-ogbòn)	34	4 + 30
márundínlogójì (mú-àrun-dín-ní-ogójì)	35	5 – 20 x 2
mérindínlogójì (mú-èrin-dín-ní-ogójì)	36	4 – 20 x 2
métàdínlogójì (mú-èta-dín-ní-ogójì)	37	3 – 20 x 2
méjídínlogójì (mú-èjì-dín-ní-ogójì)	28	2 – 20 x 2
mókàndínlogójì (mú-òkan-dín-ní-ogójì)	39	1 – 20 x 2
Ogójì	40	20 x 2
àádóta (èwá-dín- [ogún-èta])	50	10 – 20 x 3
ogóta (ogún-èta)	60	20 x 3
àádórin (èwá-dín- [ogún-èrin])	70	10 – 20 x 4
ogórin (ogún-èrin)	80	20 x 4
àádórùnún (èwá-dín- [ogún-àrún])	90	10 – 20 x 5
ogórùnún (ogún-èrún)	100	20 x 5
Igba	200	200
òódúnrún (òrún-dín-irin(wó))	300	100 - 400
Irinwó	400	400
èédégbèta (òrún-dín -Igba-èta)	500	100 – 200 x 3

egbèta (igba-èta)	600	200 x 3
èédégbèrin (òrún-dín-igba-èrin)	700	100 – 200 x 4
egbèrin (igba-èrin)	800	200 x 4
èédégbèrún (òrún-dín-igba-èrún)	900	100 – 200 x 5
egbèrún (igba-èrún)	1,000	200 x 5
egbàá (igba-èwa)	2,000	200 x 10

The samples presented show that Yòrubá exploits a decimal and vigesimal system. The decimal system is applied to the numbers 1 to 10, the vigesimal system appears in higher numbers that are multiples of twenty up to 200. Interestingly, the decimal and vigesimal systems used to compute numbers from forty (40) to two hundred (200) alternately have counterparts in centenary and bicentenary systems of computation of higher numbers from 300 to 2,000. What makes the system even more complex is the introduction of base five as a computation strategy for decimals with the sequence reversed. Thus for example, 16-19 is an inverse sequence to 11-14.

The data show that Yòrubá uses the numbers, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 100 and 200 as basic computing elements. The numbers 1-5 recur in decimals while the numbers 10 and 20 recur alternately to compute higher numbers between 20 and 200. From 200, a new series begins where 100 and 200 replace 10 and 20 as computation bases.

Yòrubá has 1, 2, 3, 4, 5, 6, 7, 8, 10, 20, 30, 200 and 400 as basic elements (as evidenced by the linguistic system which shows that these numbers are not derived from other numbers). Of these, 6, 7, 8, 9, 30 and 400 are not used recurrently to derive higher numbers (except numbers that include them directly).

Yòrubá uses the arithmetical computation operations of addition, subtraction and multiplication to compute numbers. Decimal numbers (i.e. 1-10, 10-20, 20-30, etc.) exploit addition and subtraction with addition applied to 1-4 in the decimal and subtraction to 5-9. From 35, a combination of mathematical operations is introduced: multiplication and subtraction (35-39, 45-49, etc.) and multiplication and addition (41-44, 61-64, etc.). Numbers that are 10 less multiples of twenty introduce three mathematical operations: multiplication, addition and subtraction – for numbers 1-4 (i.e. 51-54, 71-74, etc.)

One other interesting fact of Yoruba numeral system, as evidenced by the linguistic form, is that Yoruba computes from right-to-left, unlike English which computes numbers from left-to-right (Hundred Tens and Unit). For instance, *márùndínlógòjì* is '5 - 20 x 2 = 35'. A computation from left-to-right will produce the number '30' (i.e. 5 - 20 = 15 x 2 = 30).

Furthermore, the computational system of Yòrubá numerals is largely anticipatory: subtraction is undertaken in anticipation of the next decimal (or centennial) number.

3.3.2. Ekirom Cardinal Numeral System

The sample below presents the crucial elements of Ekirom numeral system:

6. LINGUISTIC FORM	GLOSS	COMPUTATION SYSTEM
ígbon/ekìn(i)	1	1
ídiàn(i)	2	2
ísas(i)	3	3
íniṇ(i)	4	4
íson(i)	5	5
íchánas(i)	6	6
íchenèch(i)	7	7
ànaàniṇ(i)	8	8
òkpolòs(i)	9	9
ìyof(i)	10	10
ekintefi (ekìn-te ẹfi)	11	1 + 10
ídiàntefi (idiàn-te ẹfi)	12	2 + 10
ísaàntefi (idiaà-te ẹfi)	13	3 + 10
íniṇntefi (iniṇ-te ẹfi)	14	4 + 10
ísonlogbolo (íson -' - le - ogbolo)	15	5 – 20
íniṇlogbolo (íniṇ -' - le-ogbolo)	16	4 – 20
ísaílogbolo (ísasi -' - le-ogbolo)	17	3 – 20
ídiànlogbolo (ídiàn -' - le-ogbolo)	18	2 – 20
ekìnlogbolo (ekìn -' - le-ogbolo)	19	1 – 20
ogbolo	20	20
ekìnnogbolo (ekìn-íni-ogbolo)	21	1 + 20
ídiànnogbolo (ídiàn-íni-ogbolo)	22	2 + 20
ísaínogbolo (ísa-íni-ogbolo)	23	3 + 20
íniṇnogbolo (íniṇ-íni-ogbolo)	24	4 + 20
ísonnogbolo (íson-íni-ogbolo)	25	5 + 20
íchánasínogbolo (íchánasí-íni-ogbolo)	26	6 + 20
íchenèchínogbolo (íchenèchí-íni-ogbolo)	27	7 + 20
ànaàniṇnogbolo (ànaàniṇ-íni-ogbolo)	28	8 + 20
òkpolòsínogbolo (òkpolòsí-íni-ogbolo)	29	9 + 20
ìyofínogbolo (ìyofí-íni-ogbolo)	30	30
ekintefínogbolo (ekìn-te-ẹfi-íni-ogbolo)	31	1 + 10 + 20
ídiàntefínogbolo (idiàn-te-ẹfi-íni-ogbolo)	32	2 + 10 + 20
ísaàntefínogbolo (ísaà-te-ẹfi-íni-ogbolo)	33	3 + 10 + 20
íniṇntefínogbolo (íniṇ-te-ẹfi-íni-ogbolo)	34	4 + 10 + 20
ísonlígboḍiàn (íson-le-igbo-idian)	35	5 – 20 x 2
íniṇlígboḍiàn (íniṇ-le-igbo-idian)	36	4 – 20 x 2
ísaílígboḍiàn (ísasí-le-igbo-idian)	37	3 – 20 x 2
ídiànlígboḍiàn (ídiàn-le-igbo-idian)	38	2 – 20 x 2
ekìnlígboḍiàn (ekìn-le-igbo-idian)	39	1 – 20 x 2
ígbóḍiàn (igbo-idian)	40	20 x 2

ìyofínìgbódìàn (ìyofí-íni-igbo-ídìàn)	50	$10 + 20 \times 2$
ìgbósasì (ìgbó-ísasì)	60	20×3
ìyofínìgbósasì (ìyofí-íni-igbo-ísasì)	70	$10 + 20 \times 3$
ìgbónìṅ (ìgbó-ínìṅ)	80	20×4
ìyofínìgbónìṅ (ìyofí-íni-igbo-nìṅ)	90	$10 + 20 \times 4$
ìgbóson (ìgbó-ísonì)	100	20×5
ìgbòòfì (ìgbó-ẹfì)	200	20×10
ìgbósonle(ogbolo) (igbo-ísonì-le-ogbolo)	300	20×15
iyum	400	400
ìgbósonniyum (ìgbó-ísonì- íni-iyum)	500	$(20 \times 5) + 400$
ìgbóofiniyum (ìgbó-ẹfì-íni-iyum)	600	$(20 \times 10) + 400$
ìgbósonlogboloniyum (ìgbó-ísonì-le-ogbolo-íni-iyum)	700	$(20 \times 15) + 400$
iyumídìàn (iyum-ídìàn)	800	400×2
ìgbósonniyumídìàn (ìgbó-ísonì-íni-iyum-ídìàn)	900	$(20 \times 5) + (400 \times 2)$
ìgbòòfiniyumídìàn (ìgbó-ẹfì-íni-iyum-ídìàn)	1,000	$(20 \times 10) + (400 \times 2)$
iyumíson (iyum-íson)	2,000	400×5

Ekirom numerals exploit, basically, decimal and vigesimal system. The numbers 1-10 are basic underived elements; 11-14 are derived by adding appropriate numbers to 10. 15-19 are derived by subtracting appropriate unit number (up to 10) from 20 (the vigesimal junction).

From 31, a new system of computation is introduced in which three numbers are computed together: 31-34 adds the appropriate unit to 10 and the sum of this is added to 20; from 35 to 39, the appropriate unit is subtracted from the vigesimal element (20) multiplied by 2. This latter pattern is the regular system (except that the result is multiplied by the appropriate unit number), for all subsequent numbers between decimal junctions.

Numbers that are multiples of 10 are derived by multiplying 20 with the appropriate unit, if it is a multiple of 20, and adding 10 to the product of the pattern until the system gets to 300. At this point, a new computation system is introduced: 5 is subtracted from 20 and the result is then multiplied by 20. At 400, a new base is reached. Subsequent numbers carry out the operation already outlined above with the result being added to 400.

The basic computing elements in Ekiromi are 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20 and 400. The system has a striking alternating pattern: decimal numbers (10-20, 30-40, 50-60, etc.) exploit the operations of addition and subtraction using base five; the decade and the unit up to 4 operate addition while the decade and the unit from 5-9 manipulate the operations of addition while the decade and the unit from 5 -9 manipulate subtraction from the next vigesimal number. Multiples of 20 however operate addition of units from 1 to 9 in deriving their numbers. It is quite fascinating to note that with the decimal junction, the system divides the numbers using base five (half of the decimal) while it uses base ten within the vigesimal junctions (half of the vigesimal).

The major operational units in the computation are base five, the decimal, the vigesimal and 400.

The arithmetical operations of Ekiromi numeral system are very interesting. First of all, it carries out the operations of addition, subtraction and multiplication. In addition to this, it operates from right-to-left.

From the number '500', a new arithmetical concept of bracketing is introduced. Numbers to be multiplied are bracketed so that the operation begins with them and subsequently their product is added to the number '400'. An intriguing situation occurs with the number '700', which requires the bracketing of the 'subtraction' operation within the bracket of the multiplication operation before addition is carried out. All of these go to show the sophistication of the computation system of numerals in Ekiromi.

3.3.3 Comparing Yoruba and Ekiromi Numeral Systems

Yoruba and Ekiromi have a lot of similarities in terms of their basic computing elements. The two languages are similar in the choice the numeral 400 as basic elements. Yoruba, however, is different in assigning 30,200 and 300(?) basic status.

Ekiromi differs significantly from Yoruba in the way it uses these basic elements. While they share similarity in using the units 1 to 5 recursively, Yoruba does not use 6 to 9 recursively in operations of addition (only in multiplication). Ekiromi, on the other hand, uses 1-9 both in addition and multiplication. Another major difference is the fact that Yoruba uses the number 200 as basis for the computation of higher numbers; Ekiromi uses the number 400 for that purpose.

As regards computing operations, Yoruba and Ekiromi share similarity of computing operations of addition, subtraction and multiplication. The two languages operate subtraction in a base five system. Both languages differ along the same lines in terms of their computing operations: while Yoruba introduces subtraction within every decimal junction, Ekiromi introduces subtraction within a junction that is not a multiple of twenty and invariant addition in a decimal that is a multiple of twenty. This brings about a graphic difference between the two systems whereby subtraction appears in an alternating pattern in Ekiromi but adjacent in Yoruba.

With regard to the computing system, Yoruba and Ekiromi both compute numbers from right-to-left. They compute their numbers using the basic principles of base five, decimal and vigesimal. From any number higher than 10, Yoruba adds the first four units to the previous decimal and subtracts the next five from the subsequent decimal number. Ekiromi does the same but only for numbers 10-19, 30-39, 50-59, 70-79, etc. Yoruba forms multiples of twenty through the multiplication of twenty by the appropriate units and the decimals in-between by addition of 10 to the preceding multiple of twenty.

Yoruba derives centuries larger than 200 by the multiplication of 200 by the appropriate unit (if it is a multiple of twenty) and the subtraction of a century from the next bicentenary number (cf. *egbèta igba-èta* '200x3 = 600' and *eèdègbèta orun-din-igba-eta* '100 - 200 x 3 = 500')

Ekiromi derives centuries by multiplying the appropriate number by twenty up to the number 400. Above this number, higher numerals are derived by adding the

appropriate numeral to 400 or by multiplying 400 by the appropriate unit, if the number is a multiple of 400.

Finally, Ekiromi introduces bracketing as a strategy for computing numbers from 500. this strategy is not exploited by Yoruba.

4. Conclusion

This paper has endeavored to show that the numeral systems of African languages are the window into the cognitive process of numbers computation as carried out by the ancient Africans.

The intriguing variety of options adopted by different African languages is pointed out even as attention is drawn to the fact that this fascinating variety is today being threatened by the natural desire of modern speakers of these languages to ‘standardize’ the numeral system to conform with the decimal system prevalent in what are known as ‘world languages’. This paper advocates the urgent need to document these systems and how they are used in order not to permanently lose what Armstrong (1962) has called “a fascinating chapter in the history of mathematics and the development of human thought.”

Notes

- * An early version of this paper was read at a conference in African Linguistics organized by the Department of Linguistics & Nigerian Languages. We are grateful to Professor Mrs. Imelda Lawrence Udoh for granting us permission to include the paper in this collection.
- 1. I am grateful to Sophie Salffner for drawing my attention to many of the points in this section.
- 2. For some unknown reason, the digits of the upper limbs and those on one of the lower limbs (i.e. the number ‘fifteen’) is never considered as base for any counting system known to us.
- 3. NUPE is a Nupoid language of the Benue-Congo Family. It is spoken in Kwara state, Kogi State and Federal Capital Territory of Nigeria.
- 4. EBIRA is classified as a Nupoid language of the Benue-Congo Family. It is spoken in Kwara State, Kogi State, Nasarawa State and Edo State of Nigeria.
- 5. IGBO is an Igboid language of the Benue-Congo Family. It is spoken as the only or majority language in Abia, Anambra, Ebonyi, Enugu, and Imo States. It is also spoken in the Northeast of Delta State and the Southeast of Rivers State of Nigeria
- 6. ESAN is classified as a Edoid language of the Benue-Congo Family. It is spoken majorly in Owan and Etsako Local Government Areas of Edo State, Nigeria.
- 7. All of these numerals may be evidence of standardization as my informant pointed out that the ancient form of ‘20’ was ‘Óhú’. Indeed, she claims that the linguistic form of the numerals, in the past, had a regular ‘I-’ prefix, thus rendering them as:

ótù

ibuó
 itó
 inó
 isé
 isfi, etc.

8. YORUBA is a Yoruboid language of the Benue-Congo Family. It is spoken primarily in Oyo, Ogun, Ondo, Osun, Ekiti, Kwara and Lagos States of Nigeria. It is also spoken in Benin, Togo, UK, and USA.
9. EKIROMI is classified as an Akpes (or Abesabesi) language of the Benue-Congo Family. It is spoken in Akoko Northwest Local Government Area in Ondo State.

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Igala Numeral System: Preliminary Observations

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The numeral system of Igala displays mathematical operations of addition, multiplication and subtraction in the realisation of especially non-basic numbers in counting. It will be shown in this work that the Igala language displays addition, multiplication and subtraction operations, particularly in the construction of higher numerals. It shall also be shown that the language possesses in its structure certain characteristics which set it out as a quasi- decimal and mixed vigesimal system.

1. The Concept of a Numeral System

A numeral system is the set of counting words and the principles or rules utilized in a particular language for constructing these words (Trask 1997). Different languages utilize different means in the realisation of their various counting systems. According to Quirk and Greenbaum (1973), numerals begin from naught, represented mathematically by zero (0) onwards to enormous possibilities. Welmers (1973) observes that numeral systems use various means in signalling additions and multiplications. Welmers also observes that there are systems with different base numerals and basic numerals for counting. Whereas some systems base their counting on the physical digits, others have evolved beyond this to various advanced stages in their various mathematical experiences. For the former situation, Welmers (1973) observes that ‘twenty’ may be established as the primitive whole or upper limit evolved for counting and on which basis further mathematical operations such as multiplications are possible.

2. Organisation of Numeral Systems

Welmers (1973) accounts for the numeral system of a few African languages. As Welmers (1973:289ff) observes, certain languages such as Akan (Kwa, Ghana and Ivory Coast) possess a straightforward decimal system in which the simple numerals up to ten are as in the Akan data in (1), as follows:

(1)	u	‘one’		‘six’
		‘two’		‘seven’
		‘three’		‘eight’
		‘four’	u u	‘nine’
	u	‘five’	u	‘ten’

The words for ‘eleven’ to ‘nineteen’ in Akan are combinations of ‘ten’ plus the added value in phrasal expressions, as in (2):

(2)	u	‘twelve’	u	‘seventeen’
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Multiples of ten are said to be expressed by compounds consisting of the plural of ‘ten’ and the particular multiple:

(3) u u ‘twenty’ u ‘forty’

Additions to multiples of ten in this language are phrases like those for additions to ten:

(4) u u ‘twenty-two’ u ‘forty-four’

The unit for ‘one hundred’ in this language is with its plural form used for multiplication, being and the unit for ‘one thousand’, , with the plural form for multiplication being :

(5) u ‘five hundred’ ‘seven thousand’

Welmers (1973:290) observes that although the numerals that follow the units for ‘one hundred’ and ‘one thousand’ resemble those for addition to the multiple of ten, “...this time multiplication is involved.” And, “If a numeral lower than ten is added to one hundred or one thousand, it must be preceded by ‘and’, to avoid confusion with multiplication.”

Welmers further makes observations that Swahili (Bantu, national language in Tanzania and Kenya) and Hausa (Chadic, Nigeria, Niger and other parts of eastern West Africa) also have grades of decimal systems marked by extensive adoption of Arabic numeral words; LuGanda (Bantu, Uganda) has a basically decimal system but the forms for ‘hundred’ and ‘thousand’ are derived from ‘ten’ through changes in noun class elements.

Welmers also observes languages like Efik (Benue-Congo, Nigeria) with five as base compared to Kpelle, Jukun, Igbo (Kwa, Nigeria) and Senari which operate various grades of numeral systems with five as base though not straightforwardly, with some of these languages showing features of being decimal and vigesimal in certain respects. Welmers (1973:301) also comments on the nature of the numeral system of Yoruba (Benue-Congo, Nigeria, Benin and Togo) which is a language closely related to Igala, the object language of the present work: “For sheer complexity or at least difficulty for the learner, however, it is hard to beat the Yoruba numeral system.” Welmers goes further to also note that the system makes use of the mathematical processes all of addition, multiplication and subtraction variously in subsystems of the numeral system. Welmers (1973:303, 304) also makes miscellaneous comments on the Yoruba situation:

The system as such is best seen by starting with one through ten, then going on to twenty and its multiples (along with thirty), subtractions of ten from multiples of twenty, additions of one through four to all decimal combinations, subtractions of five down to one from the same, and finally the

subsystems found in 185 to 200. For higher numbers, the same types of formations are found, although new multiples of twenty are used. Starting with 320, multiples of twenty are subtracted from a new unit for ‘four hundred’. Still higher, multiples of ‘two hundred’ are used. The interplay of addition, subtraction, and multiplication is not entirely consistent, and continues to involve a great deal of contraction [phonologically].

Welmers (1973:304) concludes this treatment of a variety of the African numeral systems by submitting thus:

Actually, of course, any of the systems that [have] been described is perfectly viable for the purpose for which it was used in African cultures prior to extensive European influence. Items, especially cowrie shells and kola nuts, were counted seriatim, which is not difficult to learn to do. There was, however, little occasion to cite specific large numbers out of a counting context, or to practice arithmetic operations extensively. Even at that, arithmetic is by no means impossible using these systems; the great difficulty is merely in translating from one of them...

3. The Igala Numeral System

Omachonu (2011) as well as Etu (1999) and Ocheje (2001) have done some work on the Igala numeral system, noting aspects of the system and taking some thought on modifications to the system.

3.1 The State of the Numeral System

Like the case of Yoruba, the Igala numeral system is in a structurally complex state that presents quite some difficulty for the learner. Omachonu (2011:84) notes that “It appears from all indications that the traditional counting system of Igala did not go beyond the figure one thousand (1000)”. Based on observable evidence and also as in the literature (Etu 1999, Ocheje 2001 and Omachonu 2011), the forms from ‘nought’ through ‘one thousand’ are presented here. The morphological forms presented here are not necessarily as in the literature in all cases, and observation or any critic of the proposed modifications to the system shall be deferred till an opportune time. The counting in this work starts from ‘nought’ unlike as in previous literature on Igala, and presents a systematic outline and discussion of the numerals.

0		42	u
1	/	50	
2		60	
3		70	
4		80	
5	u	90	
6		100	u
7		101	u u

8		102	u	u	
9		110	u	u	
10		111	u	u	
11		112	u	u	
12		150			
13		160			
14		200			
15	u	300			
16		400	u	u	
17		500			
18		600	u	u	
19		700		u	
20	u	800		u	
21	u	900	u	u	u
22	u	1000	u	u	
29	u	1001	u	u	u
30	u	1002	u	u	u
31	u	1050	u	u	u
40		1100	u	u	u

3.1.1 Unit Expressions/Morphological Forms in the Numeral system

As it can be observed below, there are separate units for the numerals ‘zero’ to ‘ten’ in Igala.

0		6
1	/	7
2		8
3		9
4		10
5	u	

There are also other separate forms for higher units; *u* for ‘twenty’, *u* for ‘fifty’, *u u* () for ‘two hundred’, *u u u* () for ‘four hundred’, *u u u u* for ‘seven hundred’, and the highest unit is *u u u u u* ‘eight hundred’ in this hierarchy. The units for ‘two hundred’ and ‘four hundred’ may occur with an optional expression, ‘money’. This may be a pointer to the fact that these units came into the numeral system with the invention of money in Igala economy at one point or the other. Other morphological units in the numeral system are the morpheme ‘unit’, the overt

addition morpheme, *u* and the multiplication morpheme, and the subtraction morpheme, .

3.1.1 Addition in the Numeral system

The lower base numerals, particularly ‘one’ to ‘ten’, are used for counting the additions up to ‘nineteen’ in phrase combination with whatever is added. After these juxtapositions, there is the new unit, *u* for ‘twenty’:

11		16	
12		17	
13		18	
14		19	
15	<i>u</i>	20	<i>u</i>

Observe above that there is a special form for ‘one’ in the combination meaning ‘eleven (ten plus one)’, using the alternate/clitic form, instead of the fully-fledged morpheme. This alternate form also occurs everywhere else where the sum of addition brings the number to ‘plus one’ in the numeral system, as illustrated in some instances below:

21	<i>u u</i> ()	101	<i>u u</i> ()
31	<i>u u</i> ()	1001	<i>u u u</i> ()
41	<i>u u</i> ()		

Observe further from the latest set of examples that beyond ‘twenty’, in the addition of ‘one’, a new morpheme, *u* (lit. enter) ‘add’ is attached obligatorily before the added value. Notice that in counting ‘plus one’ in the thousand, the morpheme, ‘unit’ makes ‘one’ an optional expression in the thousand, as the sense of ‘unit’ may stand at this rate to also express ‘plus one’, as is shown in ‘one thousand and one’.

Beyond the observation in this work on the use of the addition marker, the *u* () , in expressing ‘plus one’ in numerals beyond ‘twenty’ in the addition of ‘one’, this form is also utilised generally in the higher numerals from ‘twenty’ as an additive form of other lower numerals generally, as in the following examples:

22	<i>u u</i> ()
23	<i>u u</i> ()
29	<i>u u</i> ()
32	<i>u u</i> ()
102	<i>u u</i> ()
110	<i>u u</i> ()
111	<i>u u</i> ()

112		u	u	
1002	u	u		u
1010	u	u		u
1019	u	u		u
1050	u	u		u
1100	u	u	u	u

For numeral values lower than ‘thousand’; from ‘twenty’ upwards, even though the expression ‘unit’ may be utilized, it is phonologically optional as we try to show using the brackets in the immediately preceding examples.

The addition template ... *u* ... involves the multiplication morpheme, (lit. attach) ‘multiply’ which we shall discuss shortly. However, the implication of multiplication for the sum of the mathematical operation does not have any straying effect on addition. An instance may be taken from:

u u u ‘one thousand and two’.

The mathematical operation of the expression will be:

u u u
eight hundred add two hundred add unit multiply two

Essentially, any number considered as a unit remains that unit; as much as any numeral times one remains that numeral as an integer. Thus, the sum of 800+200+2 units=1002. Multiplication in the addition mode is as a result a mere expression without actual mathematical productivity in this case.

The simple additive morpheme, *u* may also be used in isolation for addition. This is the case in instances such as *u* (lit. two hundred add fifty), *u u u* (lit. eight hundred add one hundred) ‘eight hundred’ and *u u u* (lit. eight hundred add two hundred) ‘one thousand’.

Whereas in phrasal combinations for simple additions of the lower numerals, ‘eleven’ to ‘nineteen’, the structural means is generally by the juxtaposition of ‘ten’, the highest unit of the base numerals that can be paired with other units below it; juxtaposition for the purpose of addition in the higher numerals is restricted only to the two isolates in the system, *u* (twenty + ten) ‘thirty’ and *u u* (four hundred + two hundred) ‘six hundred’. The hierarchy of occurrence is generally from a bigger number to a lower one without exception. Thus, the forms * *u u* (two hundred + four hundred), * *u* (ten + twenty) and maybe * (three + ten) are deviant structures for addition. ‘sixty’ however occurs, but as the sum shows, this case is rather for multiplication, and the as we shall shortly show under our discussion of multiplication is actually a shortened form for the

underlying (twenty multiply three x ten) rather than simply
* (three + ten), which is deviant.

One other interesting fact of the Igala numeral system is revealed in the hierarchical organisation of its metric system. It seems clear from the occurrence of ‘unit’ between higher numerals and numerals between ‘one’ and ‘nineteen’ that numerals ‘one’ to ‘nineteen’ are considered mere units of the lower numerals to be added to higher numerals. This system would contrast with languages like English in which the units are ‘one’ through ‘nine’ only. Observe the following examples:

1001	u	u	u	()
1002	u	u	u	
1010	u	u	u	
1019	u	u	u	
1020 *	u	u	u	u
1050 *	u	u	u	

As the ungrammaticality of the treatment of ‘twenty’ and ‘fifty’ as units in ‘one thousand and twenty’ and ‘one thousand and thirty’ suggests, these are not lower units in Igala. Thus for English it may be ‘units’, ‘tens’, ‘hundreds’, ‘thousands’, etc. But, for Igala it is ‘units’, ‘twenties’, ‘fifties’, ‘two hundreds’, ‘four hundreds’ and ‘eight hundreds’. This fact of metric hierarchy also finds relevance in counting using multiplication, as shall be demonstrated subsequently. This observation, particularly on ‘twenty’, could have been responsible for Omachonu’s (2011:17) categorisation of Igala as a language which possibly belongs to “the group of languages which have a vigesimal numeral system.”

From the data so far, it is clear that the full template for addition, considering syntactic configuration rather than phonological optionality is:

$$\text{Higher Numeral} \left(\left(\text{Additive Morpheme} - \left(\left(\text{Unit Morpheme} \right) - \text{Multiplication Morpheme} \right) - \text{Basic Numeral} \right) \right)$$

Translating this into the object language value, the template will be:

$$\text{Higher Numeral}((\text{u} - ((\text{ }) - \text{ })) \text{Basic Numeral})$$

3.1.2 Multiplication in the Numeral system

The multiplication morpheme in Igala is (lit. attach) ‘multiply’. This is the morpheme used for multiplication involving the numerals for multiplication and the lower numerals. These numerals used as bases for multiplication in the language are three; ‘unit’, ‘twenty’ and ‘fifty’. It could be observed that the forms of these numerals as discrete units in the system are different from these latter forms that

are used as units for counting other numerals. It is our proposal therefore that their morphemic contents may be expressed, as follows:

/	‘one’	and		‘units’
one			one.SEQ	
u	‘twenty’	and		‘twenties’
twenty			twenty.SEQ	
	‘unit’	and		‘fifties’
fifty			fifty.SEQ	

Observe that the discrete forms of the numerals plainly carry the meaning of the individual numeral whereas the forms used for counting carry the additional meaning (*seq*)uencer. Observe the multiplication structures below:

40		160	
60		300	
70		380	
80		400	* u
90		500	
100	u	950	
150		1000	* u

Aside which is not productive as a multiplier as observed in (3.1.1), ‘twenty’ and ‘fifty’ are highly productive as numbers for counting in the system, even though within the parameters of the lower numerals, ‘one’ to ‘nineteen’. It must be noted that recent innovation in the language now admits *u* ‘twenty’, the form without a sequencer, as a counting element in the language. Thus, the forms of numerals with can now occur with *u* instead. This is not true for the ‘fifty’ situation. Observe all these as follows:

40	u	150	*	u
60	u	160		u
70	u	300	*	
80	u	380		u
90	u	500	*	
100	u	950	*	

Metric hierarchy also finds relevance in the multiplicative counting system. The combination must have the higher numeral preceding the lower grammatically. For this reason, alternating the order otherwise would yield simply ungrammatical structural combinations:

40	*	300	*
60	*	500	*
100	* u	950	*
150	*		

3.1.3 Subtraction in the Numeral system

The subtraction morpheme in Igala is (lit. pluck) ‘subtract’.

73		299	
95	u u	999	u u
146		991	u u
150			

One very prominent fact of the Igala subtractive forms is that any number may be subtracted, lower or higher numeral. This makes the subtraction fairly straightforward without the kind of complexity associated with the other mathematical operations in the numeral system.

Observe generally that a particular numeral may be expressed using different bases (twenty or fifty particularly) or unit, or using different strategies (addition or subtraction). The case of the former is exemplified in and *u*, both denoting ‘three hundred’ on the basis of ‘fifty’ and ‘twenty’ as basic counting numerals. Also, the numeral ‘four hundred’ is equally identified by *u u* and . Note also that the forms that express sets of fifty may conveniently be converted to forms that express sets of twenties with the same numerical value. For example, ‘fifty’ may be expressed as ‘fifty’, using twenty as the basic form for counting. For instances of the latter, It could be observed that ‘one ‘hundred and fifty’ could be expressed under the mode of multiplication of under subtraction, as or as .

4. Conclusion

After generally considering the organisation of the Igala numeral system, this work observes that a decimal arrangement operates within the lower numerals, ‘one’ to ‘nineteen’ in Igala. But this occurrence would be too limited to form the basis on which to characterise Igala as operating a decimal numeral system. At best, it could be said that the system operates a quasi decimal system attested in its lower numerals. Also, the work notes that counting in sets of twenties and fifties is very productive in the language. However, this work is finally in agreement with Omachonu (2011) that the Igala numeral system is vigesimal, for one very good reason: the forms expressed on the basis of ‘fifty’ as a counting unit can all be expressed on the basis of ‘twenty’ as counting units, but not vice versa to the benefit of fifty as counting basic unit for the numeral system.

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Tone and Numeral Constructions in Edo

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This aim of this paper is to describe the interaction between tone and grammar in Edo. In particular, we examine the interaction between tone and the various numeral constructions in Edo. The constructions examined include frequency and numeral constructions, ranking and numeral constructions, days' duration and numeral constructions and reduplication of numerals. It is observed that tonal behaviour in these constructions is a function of construction types and not of any other independent consideration relating to lexical tone patterns or syntactic structures. This, then, brings to focus how such processes should be analysed within the phonological theory. We adopt a non-linear approach within the autosegmental paradigm for its strength. We also employ various options for analyzing the morphological alternations and the various tones observed. The options adopted reveal the need to recognize the presence of 'floating' high tones in some constructions, while in some others it appears more plausible to postulate tone polarisation. In all, we are able to account for the different tonal behaviour in a more principled way.

Introduction

Edo is a language spoken by about 2½ million people occupying about 10,372 square kilometers in the mid-western part of Nigeria. Elugbe (1989) classified Edo as one of the languages that constitute the Northcentral Edoid group. The Edoid group is in turn a branch of (New) Benue Congo (Williamson 1989).

The Edo language has two basic tones. These are the high and the low tones. In bisyllabic nouns, four tonal patterns can be formed in citation from these two basic tones. These are H-H; L-L; L-H and H-L. Cases of H!H can also be found in the language, but this can be regarded as a sequence of H- - H. We also have cases of automatic and non-automatic downstep in the language (cf. Amayo (1976); Elugbe (1989); Omozuwa (1992) and Adeniyi (2003).

Numeral Constructions

Numeral constructions in Edo consist of head nouns plus numeral qualifiers. Four types of these numeral qualifiers are identified in the language. These are:

- i. Frequency and Numeral Constructions
- ii. Ordinal (Numeral) Constructions.
- iii. Days and Numeral Constructions
- iv. Reduplication of Numeral.

Generally, numerals in Edo can either be bisyllabic or multisyllabic. There are just seven of these numerals with LH tonal patterns out of the 400 numerals that we examined. Those with L-H tonal patterns are:

- | | | | |
|---|------|------|---------------|
| 1 | i. | èvá | ‘two’ |
| | ii. | èhá | ‘three’ |
| | iii. | èn | ‘four’ |
| | iv. | ìs | ‘five’ |
| | v. | ìgbé | ‘ten’ |
| | vi. | ugyé | ‘twenty’ |
| | vii. | ùrí | ‘two hundred’ |

We also have two types of numeral qualifiers in the language. These are cardinal and the ordinal (cf. Amayo 1976:210). All of them begin with a vowel. Examples are as listed below:

Cardinal Numerals

- | | | | |
|---|-------|-------|---------|
| 2 | i | kpá | ‘one’ |
| | ii. | èvá | ‘two’ |
| | iii. | èhá | ‘three’ |
| | iv. | èné | ‘four’ |
| | v. | ìs | ‘five’ |
| | vi. | éha | ‘six’ |
| | vii. | íhír | ‘seven’ |
| | viii. | r r | ‘eight’ |
| | ix. | ìhĩri | ‘nine’ |
| | x. | ìgbé | ‘ten’ |

Ordinal Numerals

- | | | | |
|---|-----|---------|----------|
| 3 | i | okaro | ‘first’ |
| | ii | ógyevá | ‘second’ |
| | iii | ógyehá | ‘third’ |
| | iv | ógyen | ‘fourth’ |
| | v | ógyis | ‘fifth’ |
| | vi | ógyìgbé | ‘tenth’ |

All ordinal numerals, except *okaro* ‘first’ begin with a high tone morpheme *ógy-*

In this work, our discussion will be based on the two types of numeral constructions. These numeral qualifiers are collocated with the various shades of nominals in Edo. We will then discuss each of the four subtypes mentioned above in relation to their data, the tonal changes that are noticed, and then analyses.

a. Frequency and Numeral Constructions

ígba in Edo means ‘time’. When this word is collocated with low tone initial numerals, the result is that the tone changes to a high tone, as can be seen from the examples below:

4	i.	ígba + ‘time’	èvá ‘two’	→	ígbé!vá ‘two times’ [twice]
	ii.	ígba + ‘time’	en ‘four’	→	ígbé!n ‘four times’
	iii.	ígba + ‘time’	èhá ‘three’	→	ígbé!há ‘three times’ (trice)
	iv.	ígba + ‘time’	ìyévà ‘forty’	→	ígbí!yévà ‘forty times’
	v.	ígba + ‘time’	ìyéhà ‘sixty’	→	ígbí!yéhà ‘sixty times’
	vi.	ígba + ‘time’	kpá ‘one’	→	ígb kpá ‘one time’ [once]
	vii.	ígba + ‘time’	éha ‘six’	→	ígbé!hà ‘six times’

From the examples given above, we see that at morpheme boundaries where two lows are collocated; the output is always a high tone. Even in cases where we have L#H at morpheme boundary, what we have as output are usually high tones. Apparently, we may have no justification for the claim that it is the deletion of the low tones of L#H at morpheme boundary when we put this side by side with other constructions where we have L#L. We may, however, have two possible ways of accounting for the presence of this high tone in the output. One is to assume that it is a floating high tone, just as

‘rank’			‘three’		‘third’
iii. ùkpó #	gyè	#	evá	→	ùkpógyevá
‘rank’			‘two’		‘second’
iv. ùkpó #	gyè	#	kpá	→	ùkpógy kpá
‘rank’			‘one’		‘first’
v. ùkpó #	gyè	#	ehã	→	ùkpógyehã
‘rank’			‘six’		‘sixth’
vi. ùkpó #	gyè	#	ìhírí	→	ùkpógíhírí
‘rank’			‘nine’		‘nineth’
vii. ùkpó #	gyè	#	er r	→	ùkpógyér r rí
‘rank’			‘eight’		‘eighth’
viii. ùkpó #	gyè	#	ìyevá	→	ùkpógíyevá
‘rank’			‘forty’		‘fortieth’
ix. ùkpó #	gyè	#	ìyéhà	→	ùkpógíyéhà
‘rank’			‘sixty’		‘sixtieth’
x. ùkpó #	gyè	#	ìyén	→	ùkpógíyén
‘rank’			‘eighty’		‘eightieth’

When the word indicating ranking is collocated with the cardinal numeral, the final vowel of the word indicating ranking is deleted for the initial vowel of the numeral. However, after collocation, the low tones across boundary change to high tones. Even, subsequent low tones on the cardinal vowels change to high tones (except the final low tones). There are two approaches to account for the high tones in this type of construction. One approach is to postulate a floating high tone between the word indicating ranking and cardinal numerals. In this case, we will have something like this:

9	ùkpó	#	gye	#	#	en	→	ùkpógyen
	‘rank’				FHT	‘four’		‘fourth’

The argument in favour of this approach tallies with that of the discussion and description of VCV + VCV above in which we postulate a floating high tone across word boundary. In all the examples given above, we have either L#L or L#H across

word boundary. In this case also, we will assume that the effect of this floating high tone is felt on the adjacent low tones, which change to high tones as can be seen from examples (vii) and (viii) above and which is given graphically below:

10. LHL # H # LLH → LHHHH

Another approach, which we are likely to favour, in accounting for the high tone, is to suggest a LH pattern for the initial syllable of cardinal construction after collocation. The high tone in this initial LH will then spread to all right syllables except the final syllable, which already has a low in the input. This seems to be less cumbersome in accounting for the subsequent low tones that change to high than the earlier one where we have two different rules (one is the floating high tone rule and then the spreading of the high tone to adjacent low tone).

c. Days and Numeral Constructions

When *d* is collocated with other numerals, what we have as output is quite different from the collocation of the tones. What we have is an alternation of the tone starting from the initial syllable with a high tone. Examples of these are given below:

11 i.	d 'day'	+	evá 'two'	→	d vá 'two days duration'
ii.	d 'day'	+	en 'four'	→	d n 'four days duration'
iii.	d 'day'	+	ìs 'five'	→	dis 'five days duration'
iv.	d 'day'	+	íhíra 'seven'	→	d híra 'seven days duration'
v.	d 'day'	+	uru 'two hundred'	→	d rí 'two hundred days duration'
vi.	d 'day'	+	ìgbé 'ten'	→	digbé 'ten days duration'
vii.	d 'day'	+	kpá 'one'	→	d kpá 'one day duration'

viii.	d 'day'	+	gb 'thirty'	→	d gb 'thirty days duration'
xi.	d 'day'	+	er r 'eight'	→	d r r 'eight days duration'

The cases of day's duration and numeral qualifiers are quite different from what we have under frequency and numeral qualifiers. This is because when *d* is collocated with any of the cardinal numerals to give us x... day(s) duration, what we observe here is that the initial syllable after collocation of the word and numeral qualifier takes a tone that is the polar opposite of the tone on the following syllable starting with a high tone.

There are various ways of accounting for these tonal patterns at the output. The first option is to assume that we have tone shift and tone deletion. Cases in which this is applicable are those with LH tonal patterns on the numeral qualifiers. In doing this, we will assume that after collocation, the tone on the initial syllable is deleted, while the high tone on the second syllable shifts to its position. Another option is to delete all high tones and then reassign these high tones on alternating syllables, starting from the initial syllable. The third option is to simply say that the tones on these constructions are all deleted, while we then reassign a HL melody also starting from the initial syllable. Another option is to assign floating high tone. In this case, a floating high tone will be inserted between *d* and the numeral qualifier. As beautiful as these options may appear, especially the last option, the problem we are likely to encounter is at the point of deriving either a low tone, when we have high tones or deriving a high tone when have low tones. The only option that we consider most viable and less cumbersome is the third option. This option states that the construction has its own morphemic tone, which overrides the basic tones at the input. This morphemic melody is HLH(L)(H). This will invariably save us the trouble of postulating many rules (i.e. tone shift; tone deletion rules etc.), which may be too cumbersome to account for.

d. Reduplication of Numerals

When we have full reduplication of cardinal numerals, the tone on the final syllable of the reduplicated form is usually low. The tonal combinations that we examine here include the tone of the cardinal numerals that are LH; HL; HHL; LHL and LLH. Under this section, when the inputs are fully reduplicated, they generate the output. Let us consider these examples.

	Input		Output
12 i.	ehá 'three'	→	èhé!ha 'in group of three'

ii.	en 'four'	→	èné!n 'in group of four'
iii.	éha 'six'	→	éhé!ha 'in group of six'
iv.	íhír 'seven'	→	íhí!ríhír 'in group of seven'
v.	gba 'thirty'	→	gb !gba 'in group of thirty'
vi.	ìyeva 'forty'	→	ìyeví!yeva 'in group of forty'
vii.	ìyeha 'sixty'	→	ìyehí!yeha 'in group of sixty'

The above examples represent all the tonal patterns that we have in the cardinal numerals of the language. (This is, however, with the exception of *kpá* 'one' which gives us *kp kpá* 'in group of one' which has no tonal change).

What we discover from the above examples is that after full reduplication of these cardinal numerals, vowel segments are usually deleted at morpheme boundaries, while the tones on them undergo a change. In cases where we have bisyllabic numerals being reduplicated, the tones at morpheme boundaries change to high. In cases where we have multisyllabic numerals, irrespective of the tones at morpheme boundaries, the output is always HH. It must, however, be noted that the intermediate structures do not show the final pattern. The final tonal patterns only emerge after reduplication and vowel elision as can be seen from some of the examples below:

13 i.	ehá 'three'	→	ehàèhá	→	èhé!hâ 'in group of three'
ii.	éha 'six'	→	éhaéha	→	éhé!hâ 'in group of six'
iii.	íhír 'seven'	→	íhír íhír	→	íhírihí!r 'in group of seven'

iv.	ihĩri 'nine'	→	ihĩrĩihĩrĩ	→	ì!hìrìhì!rí 'in group of nine'
v.	iyeha 'sixty'	→	iyehaiyeha	→	ìye!híyehâ 'in group of sixty'

with the tonal patterns as follows:

14.	Input		Intermediate		Output
i.	LH	→	LHLH	→	LH!F
ii.	HL	→	HLHL	→	H!HF
iii.	HHL	→	HHLHHL	→	HH!HHF
iv.	LLH	→	LLHLLH	→	L!HHH!F
v.	LHL	→	LHLLHL	→	LH!HHF

In analysing the occurrence of the above tonal alternations, we may either postulate a floating high tone between the reduplicated numerals. In this case, the floating high tone will then displace all the adjacent low tones with the exception of the initial and final lows. The other alternative which we will adopt, is just to say that the high tone(s) spread to adjacent low tones, causing them to become high with the exception of the initial and final low. Elugbe (personal communication) is of the view that the final low tones in the data should be treated as falling tones. Initially, we treated them as low tone instead of falling tones because we observed that their occurrences are predictable. However, on a closer look, we agree with Elugbe because we later see this as a floating low tone suffix morpheme for this construction which attaches obligatorily to the last syllable. By this rule, this predicts a falling tone. In all the constructions the final syllable always has a falling tone. We will then say that this falling tone survives after reduplication. Downsteps are also created as a result of the deletion of low and high tones. The low tone of the deleted vowel remains floating and causes subsequent tones to be realised as downstep.

It is, however, pertinent to note that this type of cardinal numeral reduplication and the attendant tonal alternation is peculiar to the Edo language, if we put it side by side with the Yoruba language. Although Yoruba has similar cases of cardinal numeral reduplication, the tones on them do not undergo any peculiar changes. Let us consider some examples from Yoruba.

15 i.	mérin 'four'	→	mérinmérin 'in group of four'
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ii.	méjì 'two'	→	mejìmejì 'in group of two'
iii.	méwàá 'ten'	→	méwàáméwàá in group of ten'
iv.	méjọ 'eight'	→	méjọméjọ 'in group of eight'

We see from the above examples that there are no tonal changes. There is also no vowel elision at morpheme boundary. We may, however, attribute this to the fact that the nasal consonant at the morpheme boundary is opaque to both tonal and vowel changes.

Conclusion

An attempt was made in this work to look at roles of tones in numeral constructions. The four types of numeral constructions that we examined are Frequency and Numeral Constructions; Ordinal (Numeral) Constructions; Days and Numerals Constructions and the Reduplication of Numerals.

Based on the peculiarities of tonal behaviour in each of these four numeral constructions, we explore various options in accounting for the morphotonemic alternations and other tonal changes observed. Some of these options include polarization (as in the case of day's duration); floating high tone (as in the case of frequency and numeral construction); postulation of LH tonal pattern. (as in the case of ordinal constructions) and high tone spreading (as in the case of reduplication of numerals).

The options mentioned above were later adopted after exploring other alternative possessive based on their strengths and weaknesses.

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The Yorùbá Numeral System: A Review in Relation to other Numeral Systems

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Yorùbá numerals have been seen as one of the most interesting but quite complicated numeral systems of world languages. In this paper, we present the various features of the Yoruba numeral system vis-à-vis other popular numeral systems. From the study, we are able to support the claim that the derivation of higher numerical values in Yorùbá involves very complex, cumbersome and complicated processes of multiplication, addition and subtraction.

Keywords: Numeral system, Yorùbá numeral, number

1. Introduction

One of the most important abilities we have as humans is the ability to think about number. Without it, modern economic life would be impossible, science would never have developed, and the complex technology that surrounds us would not exist. Though the full range of human numerical abilities is vast, the positive integers are arguably foundational to the rest of numerical cognition (Laurence and Margolis, 2005).

Hurford (1975) explains that number is an arithmetical value, expressed by a word, symbol, or figure, representing a particular quantity and used in counting and making calculations. Natural numbers are the familiar positive whole numbers 1, 2, 3, ... (or, on some treatments, the nonnegative whole numbers: 0, 1, 2, 3,) and they clearly play an essential part in many mathematical activities; for example, counting and arithmetic. In addition to their practical role, numbers also have a central place in mathematical theory (Rips et al., 2008).

As discussed in Boyer (1944), it is clear that the concept of number and the ability to count do not necessarily follow upon language, or a fortiori, from written representation. Numerational notations developed only when attempts were made to transmit and preserve records and ideas with respect to number, and when aids to mental calculations became necessary.

According to Chowdhury and Baishya (2011), number is an abstract idea of collection of things but numerals are man-made symbols that represent the numbers. Numbers are always the same value, no matter what symbol or word is used to represent them. As for example, *1*, *I*, *i* all three numerals represent the same number we know as one.

Counting and or numbering is an integral and inseparable part of the grammar of any language because there is hardly any meaningful linguistic discourse in a language that does not make reference to quantity, size, time, distance and weight in definite numbers (Omachonu, 2011). It has been noted that the use of numbers and their power in capturing concepts makes them indispensable in effective communication (Goyvaerts, 1980).

In society today, numbers are seen as an indispensable tool in our day-to-day activities. As noted in Zaslavsky (1994), key advancement in civilization can be traced

to the conception, invention, representation, and manipulation of numbers to facilitate accurate rendering of measurable objects. This has made the use of numbers an important tool within the society. They are mostly used in trade, cosmology, mathematics, divination, music, medicine, etc.

Numeral system (or system of numeration) is a mathematical notation for representing numbers of a given set, using digits or other symbols in a consistent manner (Ifrah, 1999). Ideally, a numeral system will: represent a useful set of numbers (e.g. all integers, or rational numbers), give every number represented a unique representation (or at least a standard representation), reflect the algebraic and arithmetic structure of the numbers.

Numeral in whatever language and in whichever forms/patterns it takes is a clear manifestation of the ability of man to manipulate his linguistic resources to cater for his communicative needs. Numerals appear an aspect of language study which researchers, scholars and linguists pay less attention to. This neglect could be connected to certain impression that there is little or nothing else to say about it. Little did we know that there is much to say about this little. Part of our linguistic knowledge is contained in the ability to express our ideas in our mother tongue. Our linguistic knowledge remains insufficient if we are unable to count fluently, analyze how the counting is done, and understand manipulations therein (Babárinde et al., 2013).

Numeral system can be categorized based on culture and by type of notation. Numeral systems by culture are: Babylonian numerals, Egyptian numerals, Maya Numerals, Chinese numerals, Roman numerals, Hindu-Arabic Numerals, Yorùbá Numerals, etc., while Numeral system by type of notation are: Binary, Ternary, Decimal, Vigesimal, etc. (Ifrah, 1999).

According to Bailey and Borwein (2011), the Hindu-Arabic numeral system, which is considered to be the greatest mathematical discovery, is still the most commonly used symbolic representation of numbers due to its simplicity and the fact that it requires little memorization to represent practically any number.

In an early study of the Yorùbá numeral system, Mann (1887) shows how large numbers could be represented as an arithmetic combination of the basic number units and reveals that the subtraction operation plays an important role in number naming.

The peculiarity in the Yorùbá numerals was that: *very different is the framework of the Yorùbá, it can boast of a greater number of radical names of numerals, and to a large extent makes use of subtraction...* (Mann, 1887)

2. Related Works

Hall (1973) postulated that Yorùbá numeral system form compound with addition, multiplication and subtraction. He further said that where the European decimal system is based upon units of ten the functions of addition and multiplication, the Yorùbá system of numeration is based upon units of both ten and twenty with the function of addition, multiplication and subtraction. The result of this is a far more complex number system than the decimal system.

Furthermore, Hall (1973) stated some historical use of numbers in Yorùbá traditions. These are:

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- (a) number four (4) which has an ancient symbolic association with divinity.
 - (b) number four (4), sixteen (16) and square of sixteen (256) are key numbers in the Ifa system of divination and occult.
 - (c) number three (3) has some ritual association.
 - (d) the use of number seven (7) indicates that matters of importance, of consequence are at hand.
 - (e) number six (6) is a number of ritual sacrifice or domestic situation.
 - (f) number twenty (20) and the higher numerals are essentially numbers of quantity in the traditional lore, etc.

Similarly, in the work of Ekúndayò (1977) on Vigesimal numeral derivational morphology, he stated that numerals are enumerably infinite i.e. there is no longest numeral and that numerals can be created or derived especially numerals of higher values with low usage. He further stated that, in Yorùbá numeral system, multiple representations exists for those numerals which have to be created or derived because their functional load is low. He then classified Yorùbá numerals into sixteen (16) basic forms which are: One (1) to ten (10), Twenty (20), thirty (30), two hundred (200), three hundred (300), four hundred (400) and twenty thousand (20000).

Ekúndayò (1977) also identity some various subclasses of numerals as: the noun form (those which can operate like nouns), cardinal form (e.g *méta*, *mérin*, etc.) and ordinal form (e.g. *èkíní*, *èkejì*, *èketa* etc.).

In the work of Akinadé and Odéjobí (2014), they were of the opinion that key advancement in civilisation can be traced to the conception, invention, representation and manipulation of numbers to facilitate accurate rendering of measurable objects. And that Hindu-Arabic numeral is the most commonly used symbolic representation of numbers due to its simplicity and the fact that it requires little memorisation to represent practically any number.

They further explain that, apart from Yorùbá, other African languages with vigesimal numeral system are; Madingo, Mundo, Logone, Nupe, Nembe, Bingo, Efik, Vie, Igbo and Afadeh. They emphasize that Yorùbá counting system has lexemes for basic numbers from one (1) to ten (10) and six higher numerals (twenty (20), thirty (30), two hundred (200), three hundred (300), four hundred (400), and twenty thousand (20000). They also stated that another set of basic numerals are *okòó* (20), *òjì* (40), *òta* (60) and *òrin* (80). As they are used in multiples of 100 and between 200 and 20000. *okòó* is used when *ólé* (addition) or *ódín* (subtraction) is added to the vigesimal ogún and used with the multiplication formation (e.g. *okòólérúgba* - 220).

Akinadé and Odéjobí (2014) added that, numeral operators are represented by special positional words like *lé* for addition, *dín* for subtraction and *óná* for multiplication. Subtraction is also seen to have an unusual higher functional load than addition and over counting occur when a numeral is expressed in relation to a higher numeral. They further noted that, in Yorùbá numeral system, when *ẹ̀dín* is used with a number, it implies that the number must be reduced by a certain value. They conclude that, Yorùbá numeral system is not fully vigesimal, elements of decimal and quinary (base 5) are also used in its representation.

According to Babárindé et al. (2013), Yorùbá numeral maintain a VCV (disyllabic) open syllabic structure while English numeral has a monosyllabic closed syllabic structure CVC for numeral 1, 5, 9 and 10, CVCC for 6, and VC for 8. They also assert to the study in Akinadé and Odéjobí (2014) and Ekúndayò (1977) that, numerals 200, 300 and 400 are basic in Yorùbá numeral system. They stated that, numerals 500, 700 and 900 are derived through a combination of subtraction and multiplication whereas 600, 800 and 1000 are derived by multiplying 200 by 3, 4, and 5 respectively. More so, they affirm that Yorùbá numerals present somewhat more complex derivation processes of using conventional terms as *léni* (increase by/more than) and *ódín/dinní* (it reduces/reduces) to derive numbers 11 to 14 and 15 to 19 and so on up to 99.

They further explain that, in Yorùbá 'l' and 'n' are allophones, therefore, while 'n' goes with nasalised vowel, 'l' goes with oral vowels. Such that in *dín-ní-ogún* (less than twenty), the combination of *ní-ogún* becomes *lógún* because the nasal vowel 'l' after 'n' is deleted at the junction.

Babárindé et al. (2013) concludes by accepting the argument in Ekúndayò (1977) and Oyetade (1996) that the complexity of deriving Yorùbá numerals involves very cumbersome and complicated manners of multiplication, addition and subtraction.

Hurford (1975) after studying the linguistic theory of Yorùbá numerals stated that, Yorùbá has what is probably the most unusual and complicated of any of the world's natural language numeral system. This he said presents a number of problems for the descriptive framework in his study and some of these problems are quite serious.

3. Yorùbá Numeral System

Yorùbá numeral is a form of a Vigesimal numeral system i.e. its numbers are mostly represented in base 20 (Ekúndayò, 1977). In Hall (1973), it was argued that where the European decimal system is based upon units of ten and the functions of additions and multiplication, Yorùbá numeral system is based upon units of both ten and twenty and the function of addition, multiplication and subtraction. But Akinadé and Odéjobí (2014) argued that Yorùbá numeral system is not fully vigesimal, elements of decimal and quinary (base 5) are also used in its numeral representation.

According to Mann (1887), large numbers could be represented as an arithmetic combination of the basic number units and subtraction operation plays an important role in Yorùbá number naming.

In Oyetade (1996), the following represents the pattern of the traditional Yorùbá Vigesimal number system:

One to ten are basic words and eleven to fourteen is expressed as $1 + 10$, $2 + 10$, $3 + 10$ and $4 + 10$ respectively. Fifteen to nineteen are expressed as $20 - 5$, $20 - 4$, $20 - 3$, $20 - 2$, $20 - 1$ and twenty "ogún" is a basic word. Twenty-one to twenty-four are expressed as $20 + 1$, $20 + 2$, $20 + 3$ and $20 + 4$. Twenty-five to twenty-nine are expressed as $30 - 5$, $30 - 4$, $30 - 3$, $30 - 2$ and $30 - 1$. Thirty "ogbòn" is another basic word. A pattern similar to the one above is followed for thirty-one to thirty-four and thirty-five to thirty-nine. Forty "ogóji" from $ogún + èjì$ is expressed as 20×2 . The pattern of addition of 41 to 44 and

subtraction for 45 to 49 is followed for numbers after fifty, sixty, seventy, eighty, etc. Fifty, àádóta is 60 - 10. This pattern is followed for ààdórin (80 - 10), ààdórún (100 - 10), ààdófà (120 - 10), ààdóje (140 - 10), ààdójọ (160 - 10), ààdósán (180 - 10), and ààdówá which is also expressed as igba-ódín-mẹwàá, or mẹwàá-dín-igba (200 - 10). The pattern of multiplication for forty is followed for 60 ọgóta ($20 * 3$), 80 ọgórín ($20 * 4$), 100 ọgórún ($20 * 5$), 120 ọgófà ($20 * 6$), 140 ọgójẹ ($20 * 7$), 160 ọgójọ ($20 * 8$), 180 ọgósán ($20 * 9$) and another basic word, igba is used for 200"

These patterns seem not to follow any meaningful or easy way of representation. Thus, it poses a great challenge in its computation modeling. And designing an algorithm which can model the patterns identified seems rigorous.

4. Other Numeral Systems

There are other numeral systems which share interesting and similar features with Yorùbá numeral. All these numeral systems (including Yorùbá) can as well be classified based on their types of notation (e.g. vigesimal, decimal, etc.). Some of these are discussed below:

I. Babylonian numeral system

Babylonian numerals were written in cuneiform, using a wedge-tipped reed stylus to make a mark on a soft clay tablet which would be exposed in the sun to harden to create a permanent record. The Babylonians, who were famous for their astronomical observations and calculations (aided by their invention of the abacus), used a sexagesimal (base-60) positional numeral system inherited from either the Sumerian or the Eblaite civilizations (Chrisomalis, 2010).

The Babylonian system is credited as being the first known positional numeral system, in which the value of a particular digit depends both on the digit itself and its position within the number. This was an extremely important development, because non-place-value systems require unique symbols to represent each power of a base (ten, one hundred, one thousand, and so forth), making calculations difficult. The Babylonian numeral system clearly used internal decimal to represent digits, but it was not really a mixed-radix system of bases 10 and 6, since the ten sub-base was used merely to facilitate the representation of the large set of digits needed, while the place-values in a digit string were consistently 60-based and the arithmetic needed to work with these digit strings was correspondingly sexagesimal (Chrisomalis, 2010).

In the study by Lombardi (2015), the legacy of sexagesimal still survives to this day, in the form of degrees (3600 in a circle or 600 in an angle of an equilateral triangle), minutes, and seconds in trigonometry and the measurement of time, although both of these systems are actually mixed radix. A common theory is that 60, a superior highly composite number (the previous and next in the series being 12 and 120), was chosen due to its prime factorization: $2 * 2 * 3 * 5$, which makes it divisible by 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, and 30. Integers and fractions were represented identically a radix point was not written but rather made clear by context.

uppermost), one (a dot) and five (a bar). For example, thirteen is written as three dots in a horizontal row above two horizontal lines stacked above each other. Numbers after 19 were written vertically in powers of twenty.

As explained in Thompson (1960), other than the bar and dot notation, Maya numerals can be illustrated by face type glyphs or pictures. The face glyph for a number represents the deity associated with the number. These face number glyphs were rarely used, and are mostly seen on some of the most elaborate monumental carving. The Mayan numerals is as shown in figure 3 below (0 – 19)



Fig. 3: *Maya numerals* (Source: (Derksen, 2015))

IV. Hindu-Arabic numeral system

According to Bulliet et al. (2010), Hindu-Arabic numerals are the ten digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, based on the Hindu Arabic numeral system. They are the most common symbolic representation of numbers in the world today. Arabic numerals are used to represent this Hindu-Arabic numeral system in which a sequence of digits such as "975" is read as a single number (Bulliet et al., 2010). This system was adopted by the Persian and Arab mathematicians in India, and passed on to the Arabs further west. There are some evidence which suggests that the numerals in their current form developed from Arabic letters in the western regions of the Arab World (Gandz, 1931).

In English, the term Arabic numerals can be ambiguous. It most commonly refers to the numeral system widely used in Europe and the Americas; to avoid confusion, Unicode calls these European digits. Arabic numerals are also the conventional name for the entire family of related systems of Arabic and Indian numerals. It may also be intended to mean the numerals used by Arabs, in which case it generally refers to the Eastern Arabic numerals (Chemla, 2012).

In the study carried out by Smith and Karpinski (2013), the early Hindu numerals may be classified into three great groups, (1) the Kharosthi, (2) the Brahmi, and (3) the word and letter forms. The Kharosthi numerals are found in inscriptions formerly known as Bactrian, Indo-Bactrian, and Aryan, and appearing in ancient Gandhara, now eastern Afghanistan and northern Punjab. The alphabet of the language is found in inscriptions dating from the fourth century B.C. to the third century A.D., and from the fact that the words are written from right to left it is assumed to be of Semitic origin.

As discussed in Amir-Moez (1982) and Smith and Karpinski (2013), various symbol sets are used to represent numbers in the Hindu Arabic numeral system, all of which are developed from the Brahmi numerals. The symbols used to represent the

system have split into various typographical variants since the middle ages and they are arranged in three main groups:

- the widespread Western "Arabic numerals" used with the Latin, Cyrillic, and Greek alphabets as shown in figure 4, descended from the "West Arabic numerals" which were developed in al-Andalus and the Maghreb;
- the "ArabicIndic" or "Eastern Arabic numerals" used with Arabic script, developed primarily in what is now Iraq. A variant of the Eastern Arabic numerals is used in Persian and Urdu;
- the Hindu numerals in use with scripts of the Brahmic family in India and Southeast Asia.

Hindu-Arabic	0	1	2	3	4	5	6	7	8	9
Western Arabic-Indic	٠	١	٢	٣	٤	٥	٦	٧	٨	٩
Eastern Arabic-Indic (Persian and Urdu)	۰	۱	۲	۳	۴	۵	۶	۷	۸	۹
Devanagari (Hindi)	०	१	२	३	४	५	६	७	८	९

Fig. 4: *Hindu-Arabic numerals* (Source: (Smith and Karpinski, 2013))

V. Roman numeral system

Roman numerals employs the combinations of letters from the Latin alphabet to signify values. The numbers 1 to 10 is expressed in Roman numerals as: I, II, III, IV, V, VI, VII, VIII, IX, X (Keyser, 1988) (Detlefsen et al., 1976).

Roman numeral system is a cousin of Etruscan numerals (numeral used by the ancient Etruscans). It use continued after the decline of the Roman Empire. From the 14th century on, Roman numerals began to be replaced in most contexts by more convenient Hindu-Arabic numerals; however, this process was gradual, and the use of Roman numerals in some minor applications continues even to this day (Rowlett, 2004) (Dela Cruz and Torres, 2009).

VI. Chinese numeral system

In Lip (1992), Chinese numerals are words and characters used to denote numbers in Chinese. Three written numeral systems are normally used: the system of Arabic numerals used world-wide, and the two indigenous systems. The more familiar indigenous system is based on Chinese characters that correspond to numerals in the spoken language. These are shared with other languages of the Chinese cultural sphere such as Japanese, Korean and Vietnamese. Most people and institutions in China primarily use the Arabic system for convenience, with traditional Chinese numerals used in finance, mainly for writing amounts on checks, banknotes, some ceremonial occasions, some boxes, and on commercials (Hopkins, 1916).

According to Uy (2003), Chinese numeration system is a decimal (base-ten) system, unlike other systems such as the Babylonian (sexagesimal or base-sixty) or the Mayan (vigesimal or base-twenty).

As noted in OConnor and Robertson (2001), Chinese numerals began to be used from the 4th century BC when counting boards came into use. A counting board consisted of a checker board with rows and columns. Numbers were represented by little rods made from bamboo or ivory. A number was formed in a row with the units placed in the right most column, the tens in the next column to the left, the hundreds in the next column to the left etc. The most significant property of representing numbers this way on the counting board was that it was a natural place valued system. One in the right most column represented 1, while one in the adjacent column to the left represented 10, etc.

Also in OConnor and Robertson (2001), while China has for many uses adopted the Arabic numeral system familiar around the world, it also still uses its native Chinese character number system (base-10 system), but has important differences in the way the numbers are represented. Chinese has characters for numbers 0 through 9, as shown in figure 5. In addition to the character used for zero, a simple circle can also be used. Pronunciation for the characters uses the standard Romanization scheme in China called "pinyin". The number at the end of the pinyin indicates the tone. Eleven in Chinese is "ten one". Twelve is "ten two", and so on. Twenty is "Two ten", twenty-one is "two ten one" ($2 \times 10 + 1$), and so on up to 99. One-hundred is "one hundred". One-hundred and one is "one hundred zero one". One hundred and eleven is "one hundred one ten one". Regular Chinese characters for numbers use relatively few strokes. The characters for one, two, and three are just one, two and three parallel horizontal strokes, respectively (Peterson, 1999).

The Chinese numeration system

0	zero	零	10	ten	十
1	one	一	100	one hundred	百
2	two	二	1,000	one thousand	千
3	three	三	10,000	ten thousand	萬
4	four	四	100,000	one hundred thousand	十萬
5	five	五	1,000,000	one million	百萬
6	six	六			
7	seven	七			
8	eight	八			
9	nine	九			

Fig. 5: Chinese numerals (Source: (Uy, 2003))

VII. Greek numeral system

Basically, Greek numerals are a system of representing numbers using the letters of the Greek alphabet. They are also referred to as Ionic or Ionian numerals, Milesian numerals and Alexandrian numerals (Edkins, 2006).

As noted in Edkins (2006) and Dow (1952), Greek numerals are decimal (based 10). The units from 1 to 9 are assigned to the first nine letters of the old Ionic alphabet from alpha to theta. Instead of reusing these numbers to form multiples of the higher powers of ten, however, each multiple of ten from 10 to 90 was assigned its own separate letter from the next nine letters of the Ionic alphabet from iota to koppa. Each multiple of one hundred from 100 to 900 was then assigned its own separate letter as well, from rho to sampi. (Gvozdanovic, 1992a), (Chrisomalis, 2003).

5. Conclusion

In the review, we are able to identify the structure and pattern of representing Yoruba numeral system. This when compare to other numeral systems reviewed, we understand that Yoruba numeral seems even more rigorous than others. Therefore, we believe Yoruba Numeral system is an interesting area of research. The next area for further research will be to design a computational model for the generation and translation of the numeral system.

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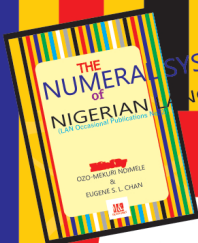
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Most of the papers in this collection were read at the workshop on the numeral systems of Nigerian languages organised by the Linguistic Association of Nigeria during its 23rd Annual Conference which was held at the University of Port Harcourt, Nigeria. The interest to organise the workshop was borne out of the awareness created by Dr. Eugene S.L. Chan on the need for Nigerian linguists to document this severely endangered but very important aspect of natural languages.

The book presents numeral systems of more than twenty (20) Nigerian languages. It is amazing to observe the quantum of mathematical computations (e.g. addition, multiplication, subtraction, or a combination of two or all of these) involved in the numeral systems of Nigerian languages. It is revealing from the discussions in this book that a variety of numerals systems do exist, such as: binary, decimal, incomplete decimal, duodecimal, quinary, quaternary, ternary, mixed, body-part tally systems, and much more.

The book is recommended to all who are interested to learn how different languages manipulate their numeral systems.



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